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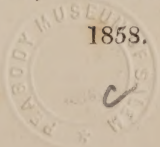
NAVIGATION
AND
NAUTICAL ASTRONOMY,
FOR THE
USE OF BRITISH SEAMEN.

BY THE
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ELEVENTH EDITION.  
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LONDON:
RIVINGTONS, WATERLOO PLACE.

1858.



1858



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LONDON: PRINTED BY W. CLOWES AND SONS, STAMFORD STREET.



ADVERTISEMENT TO THE FOURTH EDITION.

THE favourable manner in which the last edition of his Navigation and Nautical Astronomy has been received by British Seamen, has induced the Author to offer to their notice a new one, having himself revised the last with the greatest care. The rules for computation have not been altered materially, though here and there some slight change has been made, particularly when it could be done in the way of expressing a rule more simply and intelligibly. A series of easy examples, such as are of daily occurrence at sea, has been added at the end of the Nautical Astronomy, beginning at page 216 ; also different methods of correcting compass courses, &c. for the effects of a ship's local attraction (see App. Art. 61.)

Southsea, March, 1849.

7/57

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NAVIGATION.

CHAPTER I.

Definitions.—Finding Course and Distance between two known Places.—Finding the Place of the Ship, the Course and Distance from a known Place being given.—Parallel Sailing.—Meridian Sailing.—Use of Traverse Table.—Method of keeping a Ship on any given Course by the Compass.—Log-line.—Method of keeping a Log-account.—Day's Work.—Current Sailing.

(1.) NAVIGATION is the art of conducting a ship by sea from one place to another.

This is done by means of a mariner's compass and log-line; and also by means of astronomical observations. In the first place, we shall explain Navigation by mariner's compass and log-line; afterwards, in combination with this, we shall explain Navigation by astronomical observation, or, as it is usually called, Nautical Astronomy.

(2.) In Navigation by mariner's compass and log-line, the earth is considered as a sphere or globe, which is supposed to turn round one of its diameters once in 24 hours. That diameter, round which it turns, is called the earth's *axis*. The extremities of this axis are called the *poles* of the earth.

The surface therefore of the sea is spherical, and the ship's track thereon must be a curve line.

(3.) The earth is divided by a circle perpendicular to its axis into two equal parts or hemispheres, which are called the *northern* and *southern* hemispheres. The circle thus dividing it is called the *equator* or *equinoctial line*.

The poles are 90° from every point in the circumference of the equator. The pole in the northern hemisphere is called the *north pole*; the other, the *south pole*. The earth's equator extended to the celestial concave is called the celestial equator. A perpendicular to the earth's surface at the place of the spectator, when produced, cuts the celestial concave in a point called the *zenith*, which is the highest point above our heads.

(4.) Curves perpendicular to the equator, the planes of which pass through the poles, are called *meridians*. The meridian passing through any place is called the meridian of that place: thus the meridian passing through Greenwich is called the *meridian of Greenwich*.

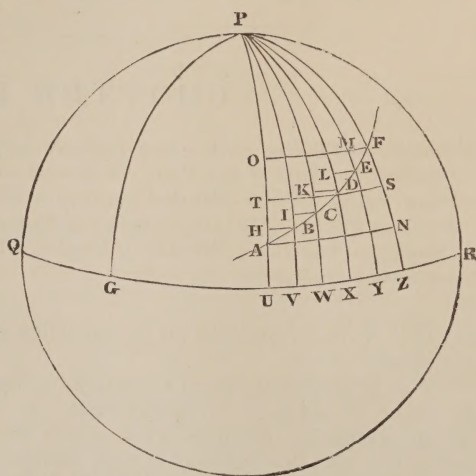
The adjoining figure represents the surface of the earth, the point P the pole of the northern hemisphere or *north pole*, QR the equator, PG the meridian of Greenwich, PAU and PFZ the meridians of any places A and F.

(5.) The direction of the meridian towards the north pole is called *north*, and marked N.; the opposite direction is called *south*, and marked S.

Directions at right angles to the meridian are called *east* and *west*; the right hand, in looking to the north, *east*; the left, *west*: they are marked E. and W.

(6.) The degrees, minutes, &c. of the equator contained between the meridian of Greenwich Observatory and the meridian of any other place, is called the *longitude* of that place. Thus GU is the longitude of A, and GZ is the longitude of F.

Longitude is reckoned from the meridian of Greenwich both *east* and *west*, as far as 180° . In the former case it is marked E., as $20^\circ 16'$ E.; in the latter it is marked W., as $115^\circ 35'$ W. The French reckon longitude from the meridian of Paris Observatory, which is $2^\circ 20' 15''$, or *in time* 9m. 21sec. E. of Greenwich.



(7.) The earth being supposed a sphere, and each meridian a circle, the degrees, minutes, &c. of the meridian of a place, contained between the place and the equator, is called the *latitude* of the place: it is marked N. or S., according as the place is to the north or south of the equator. Thus AU is the latitude of A, and is marked N, because A is to the north of QR.* The latitude of Greenwich Observatory is $51^\circ 28' 40''$ N.; that of Paris Observatory is $48^\circ 50' 14''$ N.

(8.) A small circle on the earth, which is everywhere at the same distance from the equator, that is, every point of which has the same latitude, is called a *parallel of latitude*. Thus AN and OF are parallels of latitude.

The plane of such a circle is evidently parallel to the equator.

(9.) In navigation, a ship is supposed to sail from one place to another on a track cutting all the meridians passing through it at the same angle; and thus a ship, in sailing from A to F, is supposed to describe in the sea a curve AF, which cuts the meridians PA, PB, PC, &c. at the same angle; that is, the angles PAF, PBF, PCF, &c. are supposed to be equal.

This common angle is called the *course*. The length of the line AF, expressed in minutes of a great circle of the earth, is called the *distance*.

* A perpendicular to the surface of the earth, supposing it to be a sphere, would pass through the centre, and its inclination to the equator would be measured by the said arc of the meridian in degrees, minutes, &c. Supposing the earth to be only *nearly* a sphere, and the meridians not circular arcs, such a perpendicular would pass only *near* the centre, and its inclination to the equator could not be measured by any part of the meridian. It would be measured by the arc of a great circle in the celestial concave between the zenith (the extremity of the said perpendicular) and the celestial equator: which arc therefore is in strictness the *latitude*. (See Art. 3.)

Minutes of a great circle are usually called *nautical miles*, or simply *miles*.

(10.) Let AF (see fig. Art. 6) be the track of the ship in the sea, and let PU, PV, PW, &c. be meridians dividing AF into several equal parts at B, C, D, &c. Then the angles PAB, PBC, PCD, &c. are equal. Let AN, BH, CI, DK, EL, FO, be parallels of latitude, and TS another parallel of latitude at the middle latitude between A and O. Let PG be considered as the meridian of Greenwich.

Then AF is the distance (*dist.*) between A and F. The arc AU is the latitude of A, and FZ or OU is the latitude of F; consequently AO is the true difference of latitude (*tr. diff. lat.*) of A and F. Again, GU is the longitude of A, and GZ is the longitude of F; consequently UZ is the difference of longitude (*diff. long.*) of A and F.

Supposing the parts AB, BC, CD, &c., into which AF is divided, to be indefinitely diminished and their number to be indefinitely increased, the sum of BH, CI, DK, &c., is called the departure (*dep.*).

Since BH, CI, DK, &c., are less than the corresponding parts of AN, and greater than the corresponding parts of OF, it follows that the departure is less than AN and greater than OF. In short distances it is therefore nearly equal to TS; so that TS may be considered as the departure; TU being the middle latitude between A and F, that is, being half the sum of AU and FZ.

When A and F are on different sides of the equator, that is, when the latitude of one place is north and the other south, the above reasoning respecting TS fails. In such a case, when the distance is not very great, the sum of BH, CI, DK, &c., that is the *dep.*, may be considered, without any error of importance, to be equal to TS drawn between the extreme meridians at a latitude equal to half the difference of the latitudes of A and F.

If the different portions of departure, namely, BH, CI, DK, &c., be supposed to become equal, respectively, to the differences of longitude, UV, VW, WX, &c.; the triangles ABH, BCI, CDK, &c., remaining similar to themselves during the change; then, the sum of the portions of latitude AH, BI, CK, &c., thus increased, is called the meridional difference of latitude (*mer. diff. lat.*). The latitude of any place, supposing it to be thus expanded, is found from a table: the number found being expressed in nautical miles, and called the *meridional parts* of the latitude. The difference of such meridional parts (*m.p.*) for two given latitudes is their meridional difference of latitude (*mer. diff. lat.*)* (See App. 1.)

* A ship may be considered as sailing towards or from the pole of the earth, and as being at the same time carried by a current in the sea in a direction perpendicular to the meridian. The two motions combined would produce a single motion in some line AF oblique to the meridian. What the ship, independently of the current, would approach to or recede from the pole is called *tr. diff. lat.*; what the current of itself would carry the ship is called *dep.*; and what the ship is carried in longitude or arc of equator (which is greater than *dep.*) is called *diff. long.*

Were the current (supposed perpendicular to the several meridians) to accelerate its motion, the course or angle PAB would be increased, unless at the same time the rate of sailing towards the pole were proportionally increased, in which case it would remain the same. Let the current be supposed to have accelerated its motion, so as to make it equal continually to the previous motion in longitude, and at the same time the rate of sailing in latitude to have been increased in the same proportion. On this imaginary supposition the *course* would have remained unaltered, the *dep.* would have become the previous *diff. long.*, and the *tr. diff. lat.* would now have been increased to what is called *mer. diff. lat.*

(11.) PROPORTIONS.

- (1) *dist.* : *tr. diff. lat.* :: *rad.* : *cos. course.*
 (2) *diff. long.* : *dep.* :: *rad.* : *cos. mid. lat.*
 (3) *tr. diff. lat.* : *dep.* :: *rad.* : *tan. course.*
 (4) *mer. diff. lat.* : *diff. long.* :: *rad.* : *tan. course.*

Proof of (1).

Considering the triangles ABH, BCI, CDK, &c., as right-angled plane triangles; that is, considering them in their ultimate state when diminished continually.

$$\begin{array}{llll} AB & : & AH & :: \text{rad.} : \cos. HAB \text{ or } \cos. \text{course} \\ BC & : & BI & :: \text{rad.} : \cos. IBC \text{ or } \cos. \text{course} \\ CD & : & CK & :: \text{rad.} : \cos. KCD \text{ or } \cos. \text{course} \\ & & \&c. & \&c. \end{array}$$

Consequently the sum of AB, BC, CD, &c., is to the sum of AH, BI, CK, &c., in the same proportion, that is, as *rad.* : *cos. course.*

But the sum of AB, BC, CD, &c., is the *dist.* AF, and the sum of AH, BI, CK, &c., is the *tr. diff. lat.* in sailing from A to F. Wherefore

$$\text{dist.} : \text{tr. diff. lat.} : \text{rad.} : \cos. \text{course} \quad (1)$$
Proof of (2).

By Trigonometry, $UZ : TS :: \text{rad.} : \cos. TU$. But UZ is the *diff. long.* of A and F; TS is considered as the *dep.* made in sailing from A to F; TU is the *mid. lat.* between A and F. Wherefore

$$\text{diff. long.} : \text{dep.} :: \text{rad.} : \cos. \text{mid. lat.} \quad (2)$$

Proof of (3).

Considering, as above, ABH, BCI, CDK, &c., as right-angled plane triangles.

$$\begin{array}{llll} AH & : & HB & :: \text{rad.} : \tan. \text{course} \\ BI & : & IC & :: \text{rad.} : \tan. \text{course} \\ CK & : & KD & :: \text{rad.} : \tan. \text{course} \\ & & \&c. & \&c. \end{array}$$

Consequently the sum of AH, BI, CK, &c., is to the sum of HB, IC, KD, &c., as *rad.* to *tan. course.* But the sum of AH, BI, CK, &c., is the *tr. diff. lat.*; and the sum of HB, IC, KD, &c., is the *dep.* Wherefore

$$\text{tr. diff. lat.} : \text{dep.} :: \text{rad.} : \tan. \text{course.} \quad (3)$$

Proof of (4).

When the triangles ABH, BCI, CDK, &c., are expanded, so that HB, IC, KD, &c., are each equal to the corresponding difference of longitude UV, VW, WX, &c., the triangles still remaining similar to themselves, that is, retaining the same angles as before, the sum of AH, BI, CK, &c., becomes the *mer. diff. lat.*; and from the similarity of the triangles proportion (3) will still hold good, that is,

$$\text{mer. diff. lat.} : \text{diff. long.} :: \text{rad.} : \tan. \text{course.} \quad (4)$$

We shall first apply the above proportions (1), (2), (3), (4), in computing the course and distance between two known places, that is, between two places of which we know the latitudes and longitudes.

In doing this it is necessary to pay particular attention to the following general rule for finding by logarithms any required term of a proportion, three terms being given.

(12.) *In any proportion, if an extreme term be required, add the logarithms of the middle terms and subtract the logarithm of the other extreme term. If a middle term be required, add the logarithms of the extreme terms and subtract the logarithm of the other middle term. The result will be the logarithm of the required term. The logarithm of rad. is always 10. (See App. 2.)*

(13.) *To find the Course and Distance between two places of known latitude and longitude, by Meridional Parts.*

RULE. Put the *lat. to* under the *lat. from*, each with its proper name (N. or S.). When the names are *like*, take the difference* for the *tr. diff. lat.*; when the names are *unlike*, take the sum† for *tr. diff. lat.*; bringing the result in either case (if necessary) into minutes. From *mer. parts* of latitudes (which the Tables give in minutes, having the same names with latitudes themselves) get in a similar manner *mer. diff. lat.*; and from the longitudes given, in a similar manner also, get the *diff. long.*

Write down proportions (1) and (4), and make a dash under the terms required, namely, under the *tan. course* in (4) and under the *dist.* in (1).

Apply Art. 12 to find the *log. tan. course*, corresponding to which get the *course* ‡ from the tables. At the same opening of the tables take out the *log. cos. course*.

Then apply Art. 12 to (1), and thus find the logarithm of the *dist.* Whence from the Tables find the *dist.* itself.

Ex. 1. Required the course and distance from A to B.

Lat. A	50° 25' N.	<i>m. p.</i>	3514 N.	Long. A	27° 15' W.
B	47 12 N.		3220 N.	B	30 20 W.
	3 13	<i>mer. diff. lat.</i>	294 S.		3 5
	60				60

tr. diff. lat. 193 S.

diff. long. 185 W.

(1) *dist.* : *tr. diff. lat.* :: *rad.* : *cos. course.*

(4) *mer. diff. lat.* : *diff. long.* :: *rad.* : *tan. course.*

(4)
12.267172 (adding 10 for log. rad.)
2.468347

(1)
12.285557
9.927549

9.798825

2.358008

Course S 32° 11' W.

Dist. 228 naut. miles.

* To which put common name, when the latter or *lat. to* is the *greater*, and a contrary name to the common one, when the latter or *lat. to* is the *less*.

† To which put always the name of the latter or *lat. to*.

‡ To be reckoned *from* the name of the *tr. diff. lat.* and *towards* the name of the *diff. long.*

Ex. 2. Required the course and distance from C to D.

Lat. C	73° 15' N.	<i>m. p.</i>	6586 N.	Long. C	3° 10' W.
D	80 40 N.		8613 N.	D	9 30 E.
	<hr/> 7 25		<hr/> 2027 N;		<hr/> 12 40
	60				60
	<hr/> 445 N.				<hr/> 760 E.

$$(1) \quad \underline{\text{dist.}} \quad : \quad \text{tr. diff. lat.} \quad :: \quad \text{rad} \quad : \quad \text{cos. course.}$$

$$(4) \quad \text{mer. diff. lat.} \quad : \quad \text{diff. long.} \quad :: \quad \text{rad.} \quad : \quad \underline{\text{tan. course.}}$$

(4)	(1)
12.880814	12.648360
3.306854	9.971446
<hr/> 9.573960	<hr/> 2.676914
N 20° 33' E.	475 naut. miles.

Ex. 3. Required the course and distance from E to F.

Lat. E	0° 25' S.	<i>m. p.</i>	25 S.	Long. E	2° 20' E.
F	2 37 N.		157 N.	F	10 47 W.
	<hr/> Sum 3 2		<hr/> 182 N.		<hr/> 13 7
	60				60
	<hr/> 182 N.				<hr/> 787 W.

$$(1) \quad \underline{\text{dist.}} \quad : \quad \text{tr. diff. lat.} \quad :: \quad \text{rad.} \quad : \quad \text{cos. course.}$$

$$(4) \quad \text{mer. diff. lat.} \quad : \quad \text{diff. long.} \quad :: \quad \text{rad.} \quad : \quad \underline{\text{tan. course.}}$$

(4)	(1)
12.895975	12.260071
2.260071	9.352635
<hr/> 10.635904	<hr/> 2.907436
N 76° 59' W.	808 naut. miles.

(14.) To find the Course and Distance between two places of known latitude and longitude, by Middle Latitude.

RULE. Proceed to get the *tr. diff. lat.* and *diff. long.* as in RULE Art. 13. Also, when the *lat. from* and *lat. to* have like names (both N. or both S.) take their sum and half their sum, which mark *mid. lat.*; when *lat. from* and *lat. to* have *unlike* names (one N. and the other S.) take their difference and half their difference, which mark *mid. lat.*

Write down proportions (1), (2), (3), and make a dash in (1) and (3) under the terms required, namely, in (1) under *dist.* and in (3) under *tan. course.* Then in (2) add the logarithms of the extreme terms, which will give the sum of the logarithms of the two middle terms in (2) or in (3). Subtract the logarithm of the unmarked extreme term in (3). The result will be the *log. tan. course.* Find the *course* from the Tables (Note † Art. 13), and at the same opening take out the *log. cos. course.*

Then apply Art. 12 to (1) and find logarithm of *dist.*; whence from the Tables find the *dist.* itself.

Ex. 1. Required the course and distance from A to B.

Lat A	50° 25' N.	50° 25' N.	Long. A	27° 15' W.
B	47 12 N.	47 12 N.	B	30 20 W.
	<u>3 13</u>	<u>2)97 37</u>		<u>3 5</u>
	60			60
	<u>193 S.</u>	<i>mid. lat.</i> 48 48		<u>185 W.</u>

- (1) *dist.* : *tr. diff. lat.* :: *rad.* : *cos. course.*
 (2) *diff. long.* : *dep.* :: *rad.* : *cos. mid. lat.*
 (3) *tr. diff. lat.* : *dep.* :: *rad.* : *tan. course.*

(2) and (3)	(1)
2.267172	12.285557
9.818681	9.927151
<u>12.085853</u>	<u>2.358406</u>
2.285557	Dist. 228.2 naut. miles.
<u>9.800296</u>	
Course S 32° 16' W.	

Ex. 2. Required the course and distance from C to D.

Lat. C	73° 15' N.	73° 15' N.	Long. C	3° 10' W.
D	80 40 N.	80 40 N.	D	9 30 E.
	<u>7 25</u>	<u>153 55</u>		<u>12 40</u>
	60			60
	<u>445 N.</u>	<i>mid. lat.</i> 76 57		<u>760 E.</u>

- (1) *dist.* : *tr. diff. lat.* :: *rad.* : *cos. course.*
 (2) *diff. long.* : *dep.* :: *rad.* : *cos. mid. lat.*
 (3) *tr. diff. lat.* : *dep.* :: *rad.* : *tan. course.*

(2) & (3)	(1)
2.880814	12.648360
9.353726	9.969909
<u>12.234540</u>	<u>2.678451</u>
2.648360	476.9 naut. miles.
<u>9.586180</u>	
N 21° 5' E.	

Ex. 3. Required the course and distance from E to F.

Lat. E $0^{\circ} 25' S.$	$0^{\circ} 25' S.$	Long. E $2^{\circ} 20' E.$
F 2 37 N.	2 37 N.	F 10 47 W.
<hr/> 3 2	<hr/> 2 12 Diff.	<hr/> 13 7
60		60
<hr/> 182 N.	mid. lat. 1 6	<hr/> 787 W.

- (1) $\frac{\text{dist.}}{\text{tr. diff. lat.}} :: \frac{\text{rad.}}{\text{cos. course.}}$
 (2) $\frac{\text{diff. long.}}{\text{tr. diff. lat.}} :: \frac{\text{rad.}}{\text{cos. mid. lat.}}$
 (3) $\frac{\text{tr. diff. lat.}}{\text{tr. diff. lat.}} :: \frac{\text{rad.}}{\text{tan. course.}}$

(2) & (3)	(1)
2.895975	12.260071
9.999920	9.352635
<hr/> 12.895895	<hr/> 2.907436
2.260071	808 naut. miles.
<hr/> 10.635824	
N $76^{\circ} 59' W.$	

- (15.) To find the Latitude in and Longitude in, by Meridional Parts, the place sailed from being given with the course and distance.

RULE. Write down proportions (1) and (4). From (1) find the *tr. diff. lat.* by Art. 12; bring this *tr. diff. lat.* (if more than $60'$) into degrees and minutes, and mark the result N. if the course has been to the *northward*, and S. when the course has been to the *southward*. Under the *tr. diff. lat.* so marked, write the *lat. from* marked N. or S. according to its proper name. When the names are *like*, take the sum, which mark with the common name; when the names are *unlike*, take the difference, which mark with the name of the greater. The result will be the *lat. in*.

From a table of meridional parts take the *m. p.* of the *lat. from* and also of the *lat. in*. When the names of *lat. from* and *lat. in* are *like*, take the difference of the *m. p.* When their names are *unlike*, take the sum. The result is the *mer. diff. lat.* Then from proportion (4) compute the *diff. long.* by Art. 12. Bring this *diff. long.* (if greater than $60'$) into degrees and minutes; mark it W. when the course has been to the *westward*, and E. when the course has been to the *eastward*. Under the result put the *long. from* with its proper name W. or E. When the names are *like*, take the sum, to which put the common name; when the names are *unlike*, take the difference, to which put the name of the greater. The result is the *long. in*.

Ex. 1. Sailed from A, S $37^{\circ} 10' W.$ 472.6 miles: required the *lat. in* and *long. in*. The *lat. A* is $27^{\circ} 20' S.$, and *long. A* is $25^{\circ} 12' W.$

- (1) $\frac{\text{dist.}}{\text{mer. diff. lat.}} :: \frac{\text{rad.}}{\text{cos. course.}}$
 (4) $\frac{\text{mer. diff. lat.}}{\text{diff. long.}} :: \frac{\text{rad.}}{\text{tan. course.}}$

(1)		(4)	
2.674494		2.641474	
9.901394		9.879740	
<hr/>		<hr/>	
2.575888 (rejecting 10)		2.521214 (rejecting 10)	
<i>tr. diff. lat.</i> 376'.6		<i>diff. long.</i> 332'.1	
<hr/>		<hr/>	
lat. from	6° 17' S.	<i>m. p.</i>	5° 32' W.
27	20 S.	1706	25 12 W.
<hr/>		<hr/>	
lat. in	33 37 S.	2144	long. in 30 44 W.
<hr/>		<hr/>	
<i>mer. diff. lat.</i> 438			

Ex. 2. Sailed from B, N 60° 45' E. 672.3 miles : required the *lat. in* and *long. in*. The lat. B is 32° 16' S., and long. B is 2° 45' W.

- (1) *dist.* : *tr. diff. lat.* :: *rad.* : *cos. course.*
 (4) *mer. diff. lat.* : *diff. long.* :: *rad.* : *tan. course.*

(1)		(4)	
2.827563		2.577492	
9.688972		10.251791	
<hr/>		<hr/>	
2.516535		2.829283	
328'.5		675'	
<hr/>		<hr/>	
lat. from	5° 28' 30 N.		11° 15' E.
32	16 0 S.	2047	long. from 2 45 W.
<hr/>		<hr/>	
lat. in	26 47 30 S.	1669	long. in 8 30 E.
<hr/>		<hr/>	
<i>mer. diff. lat.</i> 378			

Ex. 3. Sailed from C, S 50° 24' W. 736.2 miles : required the *lat. in* and *long. in*. The lat. C is 2° 40' N., and long. C is 3° 50' E.

- (1) *dist.* : *tr. diff. lat.* :: *rad.* : *cos. course.*
 (4) *mer. diff. lat.* : *diff. long.* :: *rad.* : *tan. course.*

(1)		(4)	
2.866996		2.671173	
9.804428		10.082352	
<hr/>		<hr/>	
2.671424		2.753525	
469'.3		566'.9	
<hr/>		<hr/>	
lat. from	7° 49' 18" S.		9° 26' 54" W.
2 40 0 N.	160	long. from	3 50 0 E.
<hr/>		<hr/>	
lat. in	5 9 18 S.	309	long. in 5 36 54 W.
<hr/>		<hr/>	
469			

(16.) To find the Latitude in and Longitude in, the place sailed from being given with the course and distance, by Middle Latitude.

RULE. Write down proportions (1), (2), (3); in (1) put a dash under the *tr. diff. lat.* and in (2) under *diff. long.* From (1), find by Art. 12 the *tr. diff. lat.* and thence as in the last Rule the *lat. in.* When the *lat. from* and *lat. to* have like names, take half their sum for *mid. lat.*; when *lat. from* and *lat. to* have unlike names, take half their difference for *mid. lat.*

In proportion (3) add the logarithms of the extreme terms, and from the sum subtract the *log. cos. mid. lat.*: the result will be the logarithm of *diff. long.*, whence find the *diff. long.* from the Tables, and from this proceed as in the last Rule to find the *long. in.*

Ex. 1. Sailed from A, S 37° 10' W. 472.6 miles; required the *lat. in* and *long. in.* The *lat. of A*, is 27° 20' S.; and *long. of A*, is 25° 12' W.

(1)	<i>dist.</i>	:	<i>tr. diff. lat.</i>	::	<i>rad.</i>	:	<i>cos. course.</i>
(2)	<i>diff. long.</i>	:	<i>dep.</i>	::	<i>rad.</i>	:	<i>cos. mid. lat.</i>
(3)	<i>tr. diff. lat.</i>	:	<i>dep.</i>	::	<i>rad.</i>	:	<i>tan. course.</i>
	(1)				(3) and (2)		
	2.674494				2.575888		
	9.901394				9.879741		
	<hr/>				<hr/>		
	2.575888				12.455629		
	376'.6				9.935450		
	<hr/>				<hr/>		
	6° 16' 36" S.				2.520179		
<i>lat. from</i>	27 20 0 S.				331'.3		
<i>lat. in</i>	33 36 36 S.				<hr/>		
					5° 31' 18" W.		
					<hr/>		
	Sum 60 56 36				<i>long. from</i> 25 12 0 W.		
	Half 30 28 18 <i>mid. lat.</i>				<hr/>		
					<i>long. in</i> 30 43 18 W.		

Ex. 2. Sailed from B, N 60° 45' E. 672.3 miles; required the *lat. in* and *long. in.* The *lat. of B* is 32° 16' S.; the *long. of B* is 2° 45' W.

(1)	<i>dist.</i>	:	<i>tr. diff. lat.</i>	::	<i>rad.</i>	:	<i>cos. course.</i>
(2)	<i>diff. long.</i>	:	<i>dep.</i>	::	<i>rad.</i>	:	<i>cos. mid. lat.</i>
(3)	<i>tr. diff. lat.</i>	:	<i>dep.</i>	::	<i>rad.</i>	:	<i>tan. course.</i>
	(1)				(3) and (2)		
	2.827563				2.516535		
	9.688972				10.251791		
	<hr/>				<hr/>		
	2.516535				12.768326		
	328'.5				9.939572		
	<hr/>				<hr/>		
	5° 28' 30" N.				2.828754		
<i>lat. from</i>	32 16 0 S.				674'.2		
<i>lat. in</i>	26 47 30 S.				<hr/>		
Sum	59 3 30				11° 14' 12" E.		
Half	29 31 45 <i>mid. lat.</i>				<i>long. from</i> 2 45 0 W.		
					<hr/>		
					<i>long. in</i> 8 29 12 E.		

Ex. 3. Sailed from C, S 50° 24' W. 736.2 miles; required the lat in and long. in. The lat. of C is 2° 40' N.; the long. of C is 3° 50' E.

- (1) $\text{dist.} : \text{tr. diff. lat.} :: \text{rad.} : \text{cos. course.}$
 (2) $\frac{\text{diff. long.}}{\text{tr. diff. lat.}} : \text{dep.} :: \text{rad.} : \text{cos. mid. lat.}$
 (3) $\text{tr. diff. lat.} : \text{dep.} :: \text{rad.} : \text{tan. course.}$

(1)	(3) and (2)
2.866996	2.671424
9.804428	10.082352
<hr/>	<hr/>
2.671424	12.753776
469'.3	9.999897
<hr/>	<hr/>
7° 49' 18" S.	2.753879
lat. from 2 40 0 N.	567'.4
<hr/>	<hr/>
lat. in 5 9 18 S.	9° 27' 24" W.
	long. from 3 50 0 E.
Diff. 2 29 18	<hr/>
Half 1 14 39 mid. lat.	long. in 5 37 24 W.

Parallel Sailing.

(17.) When the latitude from and the latitude to are the same, the track of the ship must be on a parallel of latitude. Thus suppose it were required to find the *course* and *dist.* from A to N (fig. Art. 6), which points have the same latitude; the course in this case is on the parallel of latitude AN, which cuts all the intermediate meridians at the same angle, namely, a right angle.

Again, when the given course from a known place is due *west* or *east*, in that case also the track of the ship must be a parallel of latitude, since the angle is 90°, in which a parallel of latitude passing through the place sailed from makes with a meridian, and consequently the direction of the parallel is *west* or *east*.

The necessary process in these cases has therefore been called *parallel sailing*. The *tr. diff. lat.* is nothing, the *dist.* is the same as the *dep.*, and the *mid. lat.* is the same as the *lat. from*. Hence the only proportion necessary in parallel sailing is

- (2) $\text{diff. long.} : \text{dep.} :: \text{rad.} : \text{cos. mid. lat.}$

(18.) To find the Course and Distance in Parallel Sailing.

RULE. Put the *long. to* under the *long. from* with their proper names W. or E. When they have *like* names, take their difference for *diff. long.*: when they have *unlike* names, take the sum for the *diff. long.*, bringing the result in either case (if necessary) into minutes, and marking it W. or E. as directed in notes * and † to Art. 13. Then write down proportion (2), and compute, by the general rule in Art. 12, the *dep.*, which will be the required *dist.* The *course* will be W. or E. according as *diff. long.* is W. or E.

Ex. 1. Required the course and distance from A to B.

Lat. A $50^{\circ} 48' N.$
 B $50 \ 48 \ N.$

Long. A $29^{\circ} 12' W.$
 B $30 \ 13 \ W.$

mid. lat. $50 \ 48$

$\begin{array}{r} 1 \ 1 \\ 60 \end{array}$

The course is W.

diff. long. $61 \ W.$

(2) $\text{diff. long.} : \text{dep.} :: \text{rad.} : \text{cos. mid. lat.}$

1.785330

9.800737

$1.586067 \quad 38'.6 \text{ dep. or dist.}$

Ex. 2. Required the course and distance from C to D.

Lat. C 80°
 D 80

Long. C $3^{\circ} 50' E.$
 D $6 \ 10 \ W.$

mid. lat. 80

$\begin{array}{r} 10 \ 0 \\ 60 \end{array}$

The course is W.

diff. long. $600 \ W.$

(2) $\text{diff. long.} : \text{dep.} :: \text{rad.} : \text{cos. mid. lat.}$

2.778151

9.239670

$2.017821 \quad 104'.2 \text{ dep. or dist.}$

(19.) *To find the Latitude and Longitude in, in Parallel Sailing.*

RULE. The *lat. in* is the same as the *lat. from*. Considering the *lat. from* or *lat. in* as the *mid. lat.*, and the given *dist.* as the *dep.*, compute from proportion (2) the *diff. long.* Bring this *diff. long.*, if necessary, into degrees and minutes, and mark the result W. or E., according as the given *course* is W. or E. Write underneath the *long. from*. If the names be *like*, the sum with the name of either will be the *long. in*; if the names be *unlike*, the difference, with the name of the greater, will be the *long. in*.

Ex. 1. Sailed from A 500 miles due west; required the latitude in and longitude in.

Lat. A $46^{\circ} 10' S.$

Long. A $125^{\circ} 10' E.$

(2) $\text{diff. long.} : \text{dep.} :: \text{rad.} : \text{cos. mid. lat.}$

$722'$

12.698970

9.840459

2.858511

722 miles.

diff. long. $12^{\circ} 2' W.$

long. from $125 \ 10 \ E.$

long. in $113 \ 8 \ E.$

lat. in $46 \ 10 \ S.$

Ex. 2. Sailed from B 506.2 miles due east; required the latitude in and longitude in.

Lat. B 5° N.		Long. B $2^{\circ} 45'$ W.	
(2) <u>diff. long.</u>	:	<u>dep.</u>	:: <u>rad.</u> : <u>cos. mid. lat.</u>
			508'.1
12.704322			
9.998344		diff. long.	$8^{\circ} 28' 6''$ E.
		long. from	2 45 0 W.
2.705978			
508.1 miles.		long. in	5 43 6 E.
		lat. in	5 0 N.

Meridian Sailing.

(20.) Sometimes the course of a ship is on a meridian due N. or S. In this case the latitude only is altered, the longitude remains the same. The method of proceeding will be apparent from the following examples.

Ex. 1. Required the course and distance from a known place A to another known place B.

Lat. A $40^{\circ} 15'$ N.	Long. A $45^{\circ} 10'$ W.
B 52 16 N.	B 45 10 W.
<hr/>	<hr/>
12 1	0 0
60	

tr. diff. lat. 721 N.

The course is evidently due N., and the distance is equal to the *tr. diff. lat.*, or 721 miles.

Ex. 2. Required the course and distance from a known place C to another known place D

Lat. C $2^{\circ} 10'$ N.	Long. C $10^{\circ} 0'$ W.
D 4 45 S.	D 10 0 W.
<hr/>	<hr/>
6 55	0 0
60	

tr. diff. lat. 415 S.

The course is evidently due S., and the *dist.* is equal to the *tr. diff. lat.* to 415 miles.

Ex. 3. A ship sails from a known place A 560 miles due S.; required the *lat. in* and *long. in*.

Lat. A $42^{\circ} 16'$ N.	Long. A $12^{\circ} 13'$ W.
----------------------------	-----------------------------

The tr. diff. lat. is 560.

	or $9^{\circ} 20'$ S.
lat. from	42 16 N.
	<hr/>
lat. in	32 56 N.

The long. in is evidently the same as the long. from, or $12^{\circ} 13'$ W.

Ex. 4. A ship sails from a known place B 328.8 miles due N.; required the lat. in and long. in.

Lat. B $3^{\circ} 25' S.$

Long. B $169^{\circ} 40' W.$

tr. diff. lat. 328.8

or $5^{\circ} 28' 48'' N.$

lat. from 3 25 0 S.

lat. in 2 3 48 N.

The long. in is evidently the same as the long. from, or $169^{\circ} 40' W.$

A Traverse Table.

(21.) A table containing the *tr. diff. lat.* and *dep.* corresponding to certain *distances* in nautical miles for every course expressed in points* or in degrees, is called a *Traverse Table*. The *dist.* is put at the top of the table; the *courses* under 4 points or 45° are put near the left-hand margin; those above 4 points or 45° are put near the right-hand margin. The corresponding *diff. lat.* and *dep.* are put in the proper columns; as marked at the *top* for courses under 4 points or 45° ; as marked at the *bottom* for courses above 4 points or 45° . (See *Naut. Tables*.)

Use of Traverse Table.

(22.) First, if the *dist.* and *course* be given, (supposed within the limits of the table,) the *tr. diff. lat.* and *dep.* may be easily found. When the *dist.* is beyond the limits of the table, it must be divided by 1, 2, 3, &c., using the smallest number that will bring the quotient within its limits: the *tr. diff. lat.* and *dep.* being taken out corresponding to the quotient as a *dist.*, they must be multiplied by the number before used as a divisor: the products will be the required *tr. diff. lat.* and *dep.*

It must not be forgotten that the titles at the *top* of the columns are to be used, when the course is less than 4 points or 45° ; and those at the *bottom*, when the course is greater than 4 points or 45° .

Since, from proportions (3) and (4) it appears that the *mer. diff. lat.* and *diff. long.* have the same proportion to each other as the *tr. diff. lat.* and *dep.*, namely, the proportion of *rad.* to *tan. course*, it follows that by looking for the *mer. diff. lat.* and *diff. long.* in the columns marked *tr. diff. lat.* and *dep.*, we shall have the same *course*.

A traverse table may be of use in working any case of a right-angled plane triangle, considering the hypotenuse as a *dist.*, one of the acute angles as a *course*, the adjacent side to this angle and the side opposite thereto respectively as *tr. diff. lat.* and *dep.* This will be made apparent by considering the proportions that hold good among the parts of the right-angled triangle, which agree with proportions (1) and (3).

This agreement is expressed by saying, that if the hypotenuse be made the *dist.* and one of the acute angles the *course*, the adjacent side will be the *tr. diff. lat.* and the opposite side the *dep.*; and conversely, if one of the sides be made the *tr. diff. lat.* and the other the *dep.*, the hypotenuse will be the *dist.* and the angle adjacent to the side taken for *tr. diff. lat.* will be the *course*.

* A point is $11^{\circ} 15'$, or $\frac{1}{4}$ th of 90° .

(23.) *To find the Course and Distance by Traverse Table and Meridional Parts.*

RULE. Proceed as by Rule, Art. 13, to get the *tr. diff. lat.*, *mer. diff. lat.*, and *diff. long.* Guess* a *dist.* corresponding to *mer. diff. lat.* and *diff. long.* considered as *tr. diff. lat.* and *dep.* Look for this *dist.* so guessed, and if the *mer. diff. lat.* and *diff. long.* be found at the same place in the columns of *tr. diff. lat.* and *dep.*, using the titles of columns either at the top or bottom of page, the course required will be seen at once at the side, but if the said numbers cannot be found there, try other *distances* near, till they are found, and thus the *course* will be determined.

Look in the Table for the *tr. diff. lat.* at the *course* just determined; the corresponding *dist.* at the top will be the *dist.* required.

When it appears that to find the course as above from the *mer. diff. lat.* and *diff. long.*, the *dist.* to be looked for is beyond the limits of the Table, work with *half* the *mer. diff. lat.* and *half diff. long.*, or if necessary with *one-third*, *one-fourth*, &c., which will give the same *course* as the whole.

When the *tr. diff. lat.* is greater than can be found at the course, look for *half*, *one-third*, &c. of the *tr. diff. lat.* and multiply the *dist.* immediately got from these by the divisor. The result will be the whole *dist.* required.

Ex. 1. Required the course and distance from A to B.

Lat. A 40° 15' N.	<i>m. p.</i> 2642	Long. A 42° 28' W.
B 41 25 N.	2735	B 46 18 W.
<hr/> 1 10	<hr/> 93 N.	<hr/> 3 50
60		60
<hr/> 70 N.		<hr/> 230 W.

The hypotenuse corresponding to 93 and 230 as the two sides of a right-angled triangle may be guessed to be 250. The distance corresponding to these as a *diff. lat.* and *dep.* is actually found to be 248, and the required *course* is N 68° W. The distance corresponding to this *course* and the *tr. diff. lat.* 70 is 187, which is the required *dist.*

Ex. 2. Required the course and distance from C to D.

Lat. C 50° 42' S.	<i>m. p.</i> 3540	Long. C 28° 30' E.
D 42 17 S.	2805	D 33 10 E.
<hr/> 8 25	<hr/> 3) 735 N.	<hr/> 4 40
60	<hr/> 245	60
<hr/> 3) 505 N.		<hr/> 3) 280 E.
168.3		93.3

* This guess may be facilitated by sketching a right-angled plane triangle, considering one side as *mer. diff. lat.* and the other as *diff. long.*: the hypotenuse (the number of miles in which may be nearly estimated by comparing it with a side) will be the *dist.* to be looked for in the first place.

The distance corresponding to 735 and 280 as *tr. diff. lat.* and *dep.* is evidently beyond the limits of the table. Dividing them by 3 the quotients are 245 and 93.3. The *dist.* corresponding to these as *tr. diff. lat.* and *dep.* may be guessed to be 300: it is found to be 262, and the corresponding *course* is N 21° E. The *distance* corresponding to 21° as a *course* and 168.3 (one-third of the real *tr. diff. lat.*) as a *tr. diff. lat.* is found to be 180, which being multiplied by 3, the required distance is 540 miles.

Ex. 3. Required the *course* and *distance* from E to F.

Lat. E 65° 42' N.	<i>m. p.</i> 5280	Long. E 2° 10' E.
F 70 30 N.	6055	F 7 12 W.
<hr/> 4 48	<hr/> 775 N.	<hr/> 9 22
60		60
<hr/> 288 N.		<hr/> 562 W.

Dividing the *mer. diff. lat.* and *diff. long.* by 4, and proceeding as in the last example, the *course* and *dist.* are found to be N 36° W. 356 miles.

(24.) *To find the Course and Distance by Traverse Table and Method of Middle Latitude.*

By inspecting proportions (1) and (2) it appears that if the *diff. long.* be considered as a *dist.* in the traverse table, and the *dep.* as a *tr. diff. lat.*, the *mid. lat.* will be the corresponding *course*. Hence the following rule for finding the *course* and *distance*.

RULE. Find the *tr. diff. lat.*, *diff. long.*, and *mid. lat.*, as directed in Rules, Arts. 13, 14. Enter the Traverse Table with *diff. long.* in minutes at the top as a *dist.*; from the column underneath at the *mid. lat.* as a *course* take the *tr. diff. lat.*, which write down and mark *dep.* Then with the real *tr. diff. lat.* and this *dep.* find the required *course* and *dist.* as follows:

Guess* a *dist.* corresponding to the *tr. diff. lat.* and *dep.*, and in the columns under this *dist.* or in some other columns near, look for *tr. diff. lat.* and *dep.* at the same *course*: when found, the said *course* and corresponding *dist.* in the table will be those required.

When the *diff. long.* is beyond the limits of the *distances* at the top of the Traverse Table, it must be divided by 2, 3, or some other number, and the quotient (supposed within the limits) must be used as a *dist.* In this case the *tr. diff. lat.* taken out must be multiplied by the divisor of the *diff. long.*, in order to get the whole *dep.*

When the real *tr. diff. lat.* got from the latitudes given, and this *dep.* would plainly give a *dist.* beyond the limits of the Table, divide each of them by 2, 3, or some other number, and use the quotients in finding a *course* and *dist.* This *course* will be the *course* required, and this *dist.* multiplied by the divisor just used will give the *dist.* required.

* The guess may be facilitated by sketching a right-angled plane triangle, considering one side as the *tr. diff. lat.*, and the other side as *dep.* The miles in the hypotenuse (which may be estimated nearly by comparing it with the sides) will be *dist.* to be first used or guessed.

Ex. 1. Required the course and distance from A to B.

Lat. A 40° 15' N.	40° 15' N.	Long. A 42° 28' W.
B 41 25 N.	41 25 N.	B 46 18 W.
<hr/>	<hr/>	<hr/>
1 10	Sum 81 40	3 50
60		60
<hr/>	<hr/>	<hr/>
	Half 40 50 <i>mid. lat.</i>	
<i>tr. diff. lat.</i> 70 N.		<i>diff. long.</i> 230 W.

Looking for the *diff. long.* 230 as a *dist.* and 41° (the nearest degree to *mid. lat.*) as a *course*, the *tr. diff. lat.* is 173.6, which by rule is to be considered as *dep.* The question is therefore reduced to this: to find a *dist.* and *course* corresponding to 70 as a *diff. lat.* and 173.6 as a *dep.* The distance guessed may be 200; the real *dist.* is found to be 187 miles, and the corresponding *course* N. 68° W.

Ex. 2. Required the course and distance from C to D.

Lat. C 50° 42' N.	50° 42'	Long. C 28° 30' E.
D 42 17 N.	42 17	D 33 10 E.
<hr/>	<hr/>	<hr/>
8 25	Sum 92 59	4 40
60		60
<hr/>	<hr/>	<hr/>
505 S.	Half 46 29 <i>mid. lat.</i>	280 E.

Looking for 280 as *dist.* and 46° as *course*, the *tr. diff. lat.* (to be considered as *dep.*) is 194.5. The *tr. diff. lat.* is therefore 505 and the *dep.* is 194.5, the former of which being evidently beyond the limits of the Table the *halves* are taken, namely, 252.5 and 97.2; the *dist.* guessed may be 280 miles: it is found to be 270 and the corresponding *course* 21°. The required *course* and *dist.* are therefore S. 21° E. and twice 270, or 540 miles.

(25.) To find the Latitude in and Longitude in, the course and distance from a known place being given, by Traverse Table and Meridional Parts.

RULE. With given *course* and *dist.* enter the Traverse Table and take out corresponding *tr. diff. lat.*, from which and *lat. from* find *lat. in*, and then *mer. diff. lat.*, as in Rule, Art. 15. At the given *course* look (in the column of the *tr. diff. lat.*) for the *mer. diff. lat.*; the corresponding *dep.* will be the *diff. long.*, from which and the *long. from*, find the *long. in*, as by Rule, Art. 15.

If the given *dist.* be beyond the limits of the Table, one-half, one-third, &c., must be used, and the resulting *tr. diff. lat.* must be multiplied by the divisor, in order to get the whole *tr. diff. lat.* required.

When the *mer. diff. lat.* is beyond the limits of the *tr. diff. lat.* in the Table, look for one-half, one-third, &c., of it, and multiply the resulting *dep.* or *diff. long.* by the divisor used, in order to get the whole *diff. long.*

Ex. 1. Sailed from A S. 41° E. 275 miles: required the latitude in and longitude in; the Lat. A 50° 48' N.; Long. A 1° 10' W.

In the Traverse Table at the distance 275 and *course* 41, the corresponding *tr. diff. lat.* is 207'.5 or 3° 27'.5 S., which being subtracted from 50° 48' N., the *lat. in* is 47° 20'.5 N., taking out the *mer. parts* for 50° 48', and 47° 20'.5, the *mer. diff. lat.* is found to be 317, to half which as a *tr. diff. lat.* and at the *course* 41°, the *dep.* is 137.8, twice which is 275.6, that is, the *diff. long.* is 4° 36' E. Hence the longitude in is 3° 26' E.

Ex. 2. Sailed from B 672 miles N. 70° W.: required the *lat. in* and *long. in*.

Lat. B, 50° 45' S.

Long. B, 179° 12' W.

Entering Traverse Table with *dist.* 168 (one-fourth of the *given dist.*) and *course* 70°, the *tr. diff. lat.* is 57.5, four times which is 230 or 3° 50' N., the whole *tr. diff. lat.* This being subtracted from 50° 45' S., the *lat. in* is 46° 55' S. The *mer. diff. lat.* for *lat. from* and *lat. in* is 350, and the *dep.* corresponding to one-fifth of this or 70, as a *tr. diff. lat.*, at the *course* 70°, is 192.6. The *diff. long.* is therefore *five times* this or 963', in degrees 16° 3' W. The *long. in* is therefore 195° 15' W., or subtracting this from 360°, it is 164° 45' E.

(26.) To find the Latitude in and Longitude in, the course and distance from a known place being given, by Traverse Table and Middle Latitude.

RULE. With given *course* and *dist.* enter the Traverse Table and take out *tr. diff. lat.*, from which and *lat. from* find *lat. in* as in Rule, Art. 15; and at the opening of the Table for finding *tr. diff. lat.* take out also the corresponding *dep.* Get the *mid. lat.* as directed in Rule, Art. 16, and at this *mid. lat.* as a *course* look in the column of *tr. diff. lat.* for the *dep.*: the corresponding *dist.* at the top will be the *diff. long.*, from which and the *long. from*, get the *long. in* as in Rule, Art. 15.

If the given *dist.* be beyond the limits of the Table, one-half, one-third, &c., must be used, and the resulting *tr. diff. lat.* and *dep.* must be multiplied by the divisor, in order to get the whole *tr. diff. lat.* and *dep.* When the *dep.* to be looked for as a *tr. diff. lat.* at the *course*, is beyond the limits of the Table, one-half, one-third, &c., must be used, and the resulting *diff. long.* multiplied by the divisor, in order to get the whole *diff. long.*

Ex. 1. Sailed from A, S. 41° E. 275 miles: required the *lat. in* and *long. in*.

Lat. A 50° 48' N.

Long. 1° 10' W.

Entering the Traverse Table with *dist.* 275 miles and *course* 41°, the *tr. diff. lat.* is 207'.5 or 3° 27'.5 S.; applying this to *lat. from*, the *lat. in* is 47° 20'.5 N. The corresponding *dep.* is taken out at the same opening, which is 180.4. The *mid. lat.*, or half sum of *lat. from* and *lat. in*, is 49° to the nearest degree. The *dist.* corresponding to 49° as a *course* and 180.4 as a *tr. diff. lat.* is found to be 275, in degrees 4° 35' E., which is the *diff. long.* Applying this to the *long. from* 1° 10' W., we have the *long. in* 3° 25' E.

Ex. 2. Sailed from B 672 miles N. 70° W. : required the lat. in and long. in.

Lat. B 50° 45' S.

Long. B 179° 12' W.

Entering the Traverse Table with 168 (one-fourth of the given *dist.*) and *course* 70°, the *tr. diff. lat.* is 57.5, and the *dep.* is 157.9. Applying four times 57.5 or 3° 50' N. to 50° 45' S., the lat. in is 46° 55' S. The *mid. lat.* to the nearest degree is 49°. The *dist.* corresponding to 49° as a *course* and 157.9 as a *tr. diff. lat.* is found to be 241. Four times this is 964' or 16° 4' W. the *diff. long.*, which being applied to the *long. from*, 179° 12' W., the *long. in* is 195° 16' W.; or, subtracting this from 360°, it is 164° 44' E.

(27.) To find the Course and Distance in Parallel Sailing by Traverse Table.

In parallel sailing, that is, in sailing on a parallel of latitude (17), the *dist.* is the same as the *dep.*, and the *lat. in* or *lat. from* is the same as the *mid. lat.* In getting the *dist.* we have therefore only to turn *diff. long.* into *dep.* or *dist.* by identifying the two proportions (1) and (2); the *course* is due east or due west.

RULE. Look for the *diff. long.* in minutes (found as in Art. 15) at the top as a *dist.*, in the column corresponding to which, find the *tr. diff. lat.* at the common *lat.* as a *course*; this *tr. diff. lat.* will be the *dist.* required.

When the *diff. long.* is beyond the limits of the table, take one-half, one-third, &c., of it, and multiply the *dist.* thus got by the divisor used, in order to get the whole *dist.* required. The *course* will be W. or E. according as the *diff. long.* is W. or E.

Ex. 1. Required the course and distance from A to B.

Lat. A 50° 48' N.	Long. A 1° 0' W.
B 50 48 N.	B 1 0 E.
<hr/>	
No difference or change of latitude.	2 0
	60
	<hr/>
	120 E.

Entering the Traverse Table with 120 as a *dist.* and 51° as a *course*, the corresponding *tr. diff. lat.* is 75.5, which is the required *dist.* The required *course* and distance are therefore East 75.5 miles.

Ex. 2. Required the course and distance from C to D.

Lat. C 30° 20' N.	Long. C 18° 26' W.
D 30 20 N.	D 29 40 W.
<hr/>	
No difference or change of latitude.	11 14
	60
	<hr/>
	3)674 W. (224 W.

The *diff. long.* 674 is beyond the limits of the table as a *dist.* Taking one-third, that is 224, the corresponding number in the *tr. diff. lat.* column, at the course 30° , is 194, and three times this is 582. Hence the required *course* and *dist.* are West 582 miles.

(28.) To find the Latitude in, and Longitude in, in Parallel Sailing, the Course and Distance from a known place being given, by Traverse Table.

As the *course* is due west or due east, the *lat. in* must be the same as *lat. from*: also the *dist.* given may be considered as *dep.*, which is to be turned into *diff. long.*, in order to get the *long. in*.

RULE. Find the given *dist.* in the *diff. lat.* column at the *lat. from* as a *course*: the *dist.* at the top will be the *diff. long.*, which (turned if necessary into degrees and minutes) mark E. when the course has been E., and W. when the course has been W.: underneath put the *long. from* with its proper name. When the names are *alike*, the sum with the common name will be the *long. in*; when the names are *unlike*, the difference with the name of the greater will be the *long. in*.

Ex. Sailed from A due west 110 miles: required the *lat. in* and *long. in*. The *lat.* of A is $60^\circ 15' S$; the longitude of A is $25^\circ 10' W$.

Looking in the Traverse Table at the *course* 60° for 110 in the *tr. diff. lat.* column, the corresponding *dist.* at the top is $220'$ or $3^\circ 40' W$. Applying this to the *long. from*, the *long. in* is $28^\circ 50' W$; the *lat. in* is $60^\circ 15' S$.

Ex. 2. Sailed from B west 600 miles: required the latitude in and longitude in.

Lat. B $45^\circ N$.

Long. B $3^\circ E$.

At the *course* 45° and *tr. diff. lat.* 200 (one-third of the given *dist.* 600), the tabular *dist.* is 283, which is one-third of the required *diff. long.* Hence $849'$ or $14^\circ 9' W$. is the *diff. long.*, and the *long. in* is $11^\circ 9' W$. The *lat. in* is $45^\circ N$.

Ex. 3. Sailed from the Land's End, 1000 miles due West: required *lat. in* and *long. in*.

Answer. Lat. in $50^\circ 4' N$.

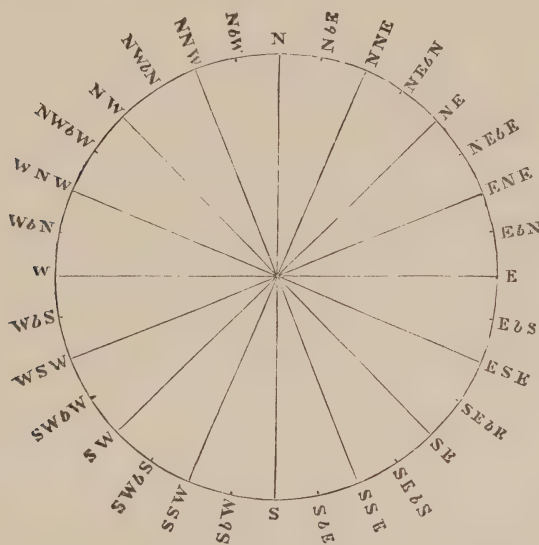
Long. in $31^\circ 38' W$.

Method of Keeping a Ship on any given Course.

(29.) A ship is kept on any given course in the open sea, by means of an instrument called the Mariner's Compass, which is constructed as follows.

The circumference of a circular card is divided into 32 equal parts, and lines are drawn from its centre to the points of division. Two points, which are opposite to each other, are marked N. and S., and the points 90°

from the N. and S. are marked E. and W. The intermediate points are marked as in the following figure.



A small bar of steel, touched by magnets, is fixed on the under side of the card, the extremities coinciding with the points marked N. and S. The card and bar together are then placed in a box, so as to turn horizontally on a fine central pin. By this motion each point on the card is brought nearly into its proper position with respect to the true north and south points of the horizon; the effect of magnetism being to turn the bar of steel or needle, and consequently the N. and S. line of the card, so as to rest nearly in the meridian. The compass, secured from the wind and sea by a glass cover, is placed in the binnacle, near the seaman who has the helm; and who is said to steer on any particular point of the compass, as N.N.W., when he brings a fore and aft line of the ship into the same direction with N.N.W. line on the card, and keeps it so.

(30.) The bar of steel or needle generally deviates something from the true north ; in some parts of the earth turning to the east, in others to the west thereof. This deviation is called the *variation* of the compass ; E. or W., according as the needle points to the east or west of the true north. Having therefore calculated the course from one place to another, as explained in the preceding articles, it becomes necessary, before that course can be steered upon by means of the Mariner's Compass, to make a proper allowance for the variation ; that is, to find what point on the card corresponds with the course determined by calculation.

(31.) To explain the method of doing this, we must first suppose a ship to lie on the calculated or true course, and the needle to be directed due north and south without any variation. In this case, as is manifest, no allowance would be required. When the ship and the compass are thus situated, let the north point of the needle turn a little to the west, that is, if the view be directed to the north, to the left. By this motion every other

point on the card will be carried to the left of its former place, that is, the course, though in reality the same, will appear by the compass to be to the right of what it was before, or to the right of the *true* course. If we suppose the needle to deviate to the eastward of the true north, in that case the contrary effect will be produced; the apparent course by the compass will be to the left of the *true* course.

By placing the card of a compass on a table, and turning it in the manner described above, the truth of these observations will become evident.

Hence we see what is meant, when, in finding the course by the compass, westerly variation is said to be allowed to the *right*, and easterly to the *left*; and also, when in reducing the true course from that by compass, westerly variation is allowed to the *left*, and easterly to the *right*.

(32.) But before the student in navigation proceeds farther on this subject, it will be necessary that he should obtain a perfect acquaintance with the names and position, with respect to each other, of the different points of the compass. In doing this he may observe that the middle point between

N. and E. is N. E.
N. and W. is N. W.
S. and E. is S. E.
S. and W. is S. W.

The names of these are got by simply putting together the letters of the principal points, between which they lie, and from which they are distant four points.

(33.) It may next be observed, that the middle point between

N. and N. E. is N. N. E.
E. and N. E. is E. N. E.
E. and S. E. is E. S. E.
S. and S. E. is S. S. E.
&c. &c.

Thus it appears, that the second set of middle points is got also by putting together the letters of the points already known, namely, N. and N. E.; E. and N. E.; &c., their distance from which is two points.

(34.) The remaining points, which may be considered as the third set of middle points, receive their names from the side on which they lie from N.; N. E.; E.; S. E.; &c.; being called N. by E.; N. by W.; N. E. by N.; N. E. by E.; &c.

By proceeding in this way, and repeating the points in the order which has been mentioned, the compass will soon be thoroughly known.

(35.) It must be noticed that the arc contained between two contiguous points is frequently called a *point*. This arc or *point*, since eight of them make 90° , must be $11^\circ 15'$; two must be equivalent to $22^\circ 30'$; three to $33^\circ 45'$; four to 45° , &c. Each of these arcs is moreover divided into four equal parts or quarters, named from their situation with respect to the contiguous point: thus the first quarter point, which is on the east of N. E., is called N. E. $\frac{1}{4}$ E.; the second, N. E. $\frac{1}{2}$ E.

The division of the compass being now supposed known, we shall proceed to give rules for shaping any given course by this instrument: and also for finding the true course steered, supposing the compass course to be known.

(36.) *To Shape the Compass Course, the True Course being given (App. 61).*

Put down the number of points (P) and quarter points (Q), which the *true course* is from the N. or S., marking them R. or L., according as they are to the right or left of N. or S. Underneath put the *variation* in points and quarter points, marking it R. or L. according as it is W. or E. If the names or letters be alike, the sum with that name will be the number of points and quarter points the *compass course* is from the N. or S.: if the names be unlike, the difference with the name of the greater will be the number of points and quarter points the *compass course* is from the N. or S., according as the true course has been reckoned from the N. or S.

True Course.		Variation.		Compass Course.	
N.	N. E.	2 $\frac{1}{4}$	W.	N.	E. $\frac{1}{4}$ E.
E.	N. E.	1 $\frac{1}{2}$	E.	N.	E. $\frac{1}{2}$ E.
S.	E. $\frac{1}{2}$ E.	3 $\frac{1}{4}$	W.	S.	b. E. $\frac{1}{4}$ E.
S.	$\frac{3}{4}$ W.	1 $\frac{3}{4}$	E.	S.	b. E.
P. Q.	P. Q.	P. Q.	P. Q.	P. Q.	P. Q.
2 0 R. of N.	6 0 R. of N.	4 2 L. of S	0 3 R. of S.		
2 1 R.	1 2 L.	3 1 R.	1 3 L.		
<hr/>	<hr/>	<hr/>	<hr/>		
4 1 R.	4 2 R.	1 1 L.	1 0 L.		
<hr/>	<hr/>	<hr/>	<hr/>		
N. E. $\frac{1}{4}$ E.	N. E. $\frac{1}{2}$ E.	S. b. E. $\frac{1}{4}$ E.	S. b. E.		

Leeway.

(37.) The point of the compass, which is directed from the steerage to the head of a ship, is called the *compass course*. There are two reasons why this may not be the true course. First, there may be a variation to allow; and secondly, the ship's track in the sea may not be in the direction of this fore and aft line: in other words, there may be an error in supposing the point of sailing shewn by the compass to be the true course, and there may be another error in supposing the line of sailing shewn by the ship to be so.

(38.) The action of the wind on the sails, rigging, and sides of a ship, when it lies near the point from which the wind blows, not only tends to impel the vessel through the water in the direction of a fore and aft line, but also presses it sideways; and thus, upon the whole, the track made in the sea is to the leeward of the apparent line on which it is directed, and makes an angle with it. This angle is called the *leeway*.

(39.) If the wind be on the right-hand side of the ship, the spectator being supposed to look forward, its track must evidently, when there is leeway, be to the left of a fore and aft line: if the wind be on the left-hand side, this track must be to the right. In the former case the ship is said to be on the *starboard tack*; in the latter, on the *larboard tack*. Hence it appears, that on the starboard tack leeway is allowed to the left, and on the larboard tack it is allowed to the right.

(40.) The amount of leeway depends on the proportion which the velocity of the ship *sideways* bears to the velocity *forward*. Under all sail this proportion is so small, that, even when the ship is close-hauled, no leeway whatever is allowed. When a less quantity of sail is carried, it is then usual to make allowances according to the sail actually set.

Although no rule can be given which will apply to all ships, yet the following one may come near the truth for ships of war.

Rule for Leeway when by the Wind.

1. Under all sail allow *no* leeway.
2. Under courses, single-reefed top-sails, and top-gallant-sails, when the water is smooth allow *no* leeway.
Where there is much swell, allow *one-quarter* of a point.
3. Under courses, double-reefed top-sails, and top-gallant-sails, allow *half* a point.
When the top-gallant-sails are furled, allow *three-quarters* of a point.
4. Under courses, treble-reefed top-sails, and top-gallant-sails, allow *one* point.
When the top-gallant-sails are furled, allow *one* point and a *quarter*.
5. Under courses, and close-reefed top-sails, allow *two* points.
6. Under courses, close-reefed fore and main top-sails, allow *two* points and a *half*.
7. Under reefed courses, and close-reefed fore and main top-sails, allow *three* points.
8. Under reefed courses, and close-reefed main top-sail, allow *three* points and a *half*.
9. Under reefed *fore-sail*, and close reefed main top-sail, allow *four* points.
10. Under storm main top-sail, allow *five* points.
11. Under storm stay-sails, allow *six* points.
12. Under bare poles, allow *seven* points.

(41.) The above allowances suppose a ship to be constructed in the common way, and to be in perfect sailing order. When a ship is light, has higher upper works, less draught of water, less sharpness of body, or less length than usual, it will in any given case make more leeway than has been stated. But such variations must be left to the judgment of the seaman.

(42.) The leeway actually made by a ship at sea may be estimated by drawing a small arc of a circle at the stern, and marking on it the points of the compass. The estimated angle between a fore and aft line produced, and the track left by the ship in the sea, will be the leeway required. This angle may also be observed by a Mariner's Compass placed at the stern.

If this were done from time to time, and recorded, seamen would perhaps be enabled to make the proper allowance with greater certainty, than by following any general rule whatever.

The leeway being supposed known, the true course may be deduced from the compass course by the following rule.

(43.) *To Correct the Compass Courses (see App. (1)).*

RULE. Put down the points and quarter points which the *compass course* is to the right or left of the N. or S., marking them R. or L. Underneath put the *variation*, marking it R. or L., according as it is E. or W. If the names be alike, take the sum with that name: if unlike, take the difference with the name of the greater. Under this put the *leeway*, marking it R. or L., according as the course is right or left of the wind. Again, take the sum with the name of either, if the names be alike; and the difference, with the name of the greater, if the names be unlike. The result will be the number of points the *true course* is from the N. or S., according as the compass course has been reckoned from the N. or S.

The compass course and true course, if more convenient, may be reckoned from the W. or E.

Compass Course.	Variation.	Leeway.	True Course.
N. N. E.	$2\frac{1}{4}$ W.	$1\frac{1}{4}$ R.	N. b. E.
N. W.	$2\frac{1}{2}$ W.	$2\frac{1}{2}$ L.	W. b. S.
S. E. $\frac{1}{2}$ E.	$3\frac{3}{4}$ E.	$3\frac{1}{4}$ R.	S. S. W. $\frac{1}{2}$ W.
W. b. S. $\frac{1}{4}$ S.	$1\frac{1}{4}$ E.	$1\frac{3}{4}$ L.	W. b. S. $\frac{3}{4}$ S.
<hr/> 2 0 R. of N.	<hr/> 4 0 L. of N.	<hr/> 4 2 L. of S.	<hr/> 6 3 R. of S.
2 1 L.	2 2 L.	3 3 R.	1 1 R.
<hr/> 0 1 L.	<hr/> 6 2 L.	<hr/> 0 3 L.	<hr/> 8 0 R.
1 1 R.	2 2 L.	3 1 R.	1 3 L.
<hr/> 1 0 R.	<hr/> 9 0 L.	<hr/> 2 2 R.	<hr/> 6 1 R.
N. b. E.	W. b. S.	S. S. W. $\frac{1}{2}$ W.	W. b. S. $\frac{3}{4}$ S.

Sometimes it may be desirable to express the course, variation, and leeway, in degrees. The method of proceeding in reducing the true course to the compass course, and conversely the compass course to the true, will be apparent from the following examples, and from the foregoing observations and directions.

True Course, &c. given in Degrees to find the Compass Course (App. 61).

True Course.	Variation.	Compass Course.
N. 50° E.	21° W.	N. 71° E.
N. 20 W.	23 W.	N. 3 E.
S. 82 E.	12 E.	E. 4 N.
<hr/> 50° R. of N.	<hr/> 20° L. of N.	<hr/> 82° L. of S.
21 R.	23 R.	12 L.
<hr/> 71 R. or N. 71° E.	<hr/> 3 R. or N. 3° E.	<hr/> 94 L. or E. 4° N.

(44.) *To Correct the Compass Course in Degrees (see App. 61).*

Compass Course.	Variation.	Leeway.	True Course.
S. 39° W.	23° W.	10° L.	S. 6° W.
N. 10° E.	20° E.	35° L.	N. 5° W.
N. 80° W.	25° W.	12° R.	W. 3° S.
39° R. of S.	10° R. of N.	80° L. of N.	
23 L.	20 R.	25 L.	
16 R.	30 R.	105 L.	
10 L.	35 L.	12 R.	
6 R.	5 L.	93 L.	
S. 6° W.	N. 5° W.	W. 3° S.	

Method of Measuring the Distance Sailed.

(45.) To determine the velocity, or degree of swiftness, with which a vessel sails, a piece of wood called the log is cast into the sea, and is then considered as a fixed point. The distance run from this point by the vessel is measured by means of a string fixed to the log, and unwound from a reel, as the vessel moves through the water.

The log is a piece of board cut out in the form of a sector of a circle. It has the curved part loaded with lead, so as to sink the whole just below the surface of the water, and at the same time to keep it in an upright position. One string is securely fixed to the central point of the log, and a second is attached, by means of a peg, to the middle of the curve. These two strings, at a short distance, are united in one; and have the effect, when stretched, of keeping the broad side of the log towards the ship, and thereby causing it to oppose the most powerful resistance to motion in that direction.

(46.) Thus prepared the log is cast into the sea, and about ten fathoms of the line, called *stray line*, is suffered to run off the reel, for the purpose of stretching it. Afterwards the length of line run off in a certain number of seconds is measured, whence the rate of sailing at that time is deduced. The person who heaves the log knows when the proper quantity of stray line is gone by a particular mark on the line, and the length afterwards run out by means of knots, which are at distances from each other, bearing the same proportion to a nautical mile that the time run by a sand-glass does to an hour. If one of these knots pass in the interval, the ship is sailing at the rate of one mile an hour; if two knots pass, it is sailing at the rate of two miles an hour; and so on.

(47.) In the operation described above of measuring a ship's way, a sand-glass running 28 seconds is generally used; in which case the knot ought to be 47 feet 3 inches, which bear the same proportion to 6075.5, the feet contained in a *mean* nautical mile, that 28 seconds do to 3600, the seconds contained in an hour. In some cases a sand-glass of 14 seconds is used, in which case the common knots run off must be doubled or a log line with half knots used. The length of the knot is frequently taken, as

little as 44 or 45 feet: by which means the sailing of the ship is over-rated. This is done with a view that the reckoning of the ship may be on the safe side in making land.

(48.) The knot is commonly supposed to be 8 fathoms; but it would be better to consider this space of 47 feet 3 inches as made up of *tenths*: for the space of 8 fathoms or 48 feet is evidently too much for the knot, when a 28 seconds sand-glass is used. Besides measuring by fathoms is attended with inconvenience in calculation, and leads to errors. The knot of 47 feet 3 inches might be divided into *double tenths* by smaller knots of 9 feet 5½ inches; and thus the distance run off would always be known to the nearest tenth.

The number of seconds run by the sand-glass, and also the length of the knots on the log-line, should from time to time be ascertained, and if necessary altered. Or, what would answer better than shifting the marks on the log-line so frequently as would thus be required, the error of several knots above or below their proper length, being determined by measurement immediately after heaving the log, at least once every day, a correction might be applied in working the day's work, from a table constructed for that purpose. Four knots should measure 189 feet; 8 should measure 378.

(49.) Suppose now a ship to sail at noon from a known place, bound to another known place. The first thing to be done is to calculate the true course as in Art. 13 or 14, 23 or 24. Having made the proper allowance for the variation (Art. 36), the compass course is thence deduced, and, if the wind permit, the ship is steered on it.

At the end of an hour, that is, at 1^h P.M., the log is hove, and the number of nautical miles and tenths of miles is determined which the ship has run in the preceding hour. At 2 P.M., the same operation is repeated.

Let the ship keep the same course till 4 P.M. Then up to this time we know the compass course, and by correcting for variation and leeway (Art. 13), the true course; and by adding up the hourly distances, we know also the whole *dist.* From a traverse table we can find the *tr. diff. lat.* and *dep.*, the former of which must be marked N. or S. the latter, E. or W.

After 4 P.M., let the ship be steered on a new course till 8 P.M., and let the distance run in each hour, from 4 to 5, from 5 to 6, &c., be measured as before. Then, correcting the compass course for variation and leeway, and adding up the miles in each hour, we again know the *course* and *dist.*; and thence, with the assistance of the traverse table, the *tr. diff. lat.* and *dep.*; which are also marked with their proper names.

(50.) Thus we may be supposed to go on till the next noon, determining, by means of the compass and the log, the different courses steered, the distance on each course; with the *tr. diff. lat.* and *dep.* on each.

Let all the *tr. diff. lat.* marked N. be added together, and all those marked S. The difference of the sums, with the name of the greater, will be the *tr. diff. lat.* upon the whole. In a similar manner the *dep.* on the whole is got, and marked E. or W. according to its name. Then the *tr. diff. lat.* and *dep.* in the preceding 24 hours being known, the distance of the ship from the place left, and the course from thence to the ship, may be determined either by logarithms or by a traverse table, from proportions (3) and (1) in Art. 11. By the course and distance thus determined

are meant the course upon which the ship must have sailed without any variation, in order to arrive at the same place, and the distance the ship must have run on that supposition.

(51.) By applying the *tr. diff. lat.* to the *lat. from*, we get the *lat. in*; we may then proceed either by the method of meridional parts, or by the method of middle latitude, to find the *diff. long.* made, from which and the *long. from* we get the *long. in*. The proportion (4) in Art. 11 is used in the former method, and proportion (2) is used in the latter.

The same thing may be done by inspection in a traverse table, by working proportion (4) under the names of (3), or (2) under the names of (1). (See Arts. 25 and 26.)

(52.) The place of the ship at the noon following the time of sailing being known, the *course* and *dist.* from thence to any other known place, or, as they are usually called, its *bearing* and *distance*, may be easily computed as in Art. 13, 14, 23, 24, &c.

(53.) The hourly distances, compass courses as they are changed from time to time, the winds, quantity of sail set, &c., are first written with chalk on a board, called a log-board, and are afterwards transcribed into a book, called the ship's log-book. At each noon the *course*, *dist.*, *lat. in*, *long. in*, and the *bearing* and *dist.*, determined as explained above, are inserted in proper spaces in this book, at the end of the previous account.

This mode of computing is called a *dead reckoning*; the work necessary each 24 hours is called a *day's work*; and the place of the ship deduced therefrom is called its place by the *log. account*, or simply *by account*.

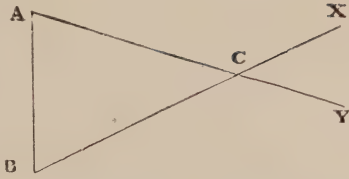
(54.) In the above sketch of the method of proceeding in keeping the dead reckoning, it has been supposed that a ship sails from a known place or point. Now this is seldom the case: on quitting the land, the point, which is known as to latitude and longitude, is usually at some distance from the ship, though within sight. This distance is commonly estimated by the eye, and its compass-bearing taken: then the ship is supposed to have sailed, on a compass course opposite to this bearing, the estimated distance from the known point; which would bring it to the place actually sailed from. This is called taking a *departure*.

Thus when a vessel leaves its anchorage, let a known point A bear N. N. E. and the estimated distance be 15 miles. Then the vessel is supposed to have sailed by compass S. S. W. 15 miles from A; and this corrected for variation is considered as the first course in the day's work. The result will evidently be the same as if the ship had really sailed, from A, 15 miles on a S. S. W. course.

Afterwards the courses steered from the situation of the ship on sailing are taken from the log-board, and corrected for variation and leeway, as has been already pointed out.

(55.) In some instances the distance of a ship from a known point, in taking its departure from the land, is found by observing the compass-bearing of that point; by then running a measured distance upon a given course, so as to change the bearing considerably; and lastly by taking the bearing of the same point again. These observations furnish sufficient data for computing the ship's distance from the known point at the time, when either bearing was taken.

Let C be the known point, A the first position of the ship when its bearing is taken, B the second. Produce AC and BC to Y and X. Then in the triangle ACB, we know the angle A between the first bearing and the ship's course; we also know the angle ACB, which is equal to XCY, the angle between the two bearings observed: lastly, we know AB the side opposite to ACB. Consequently, since the sides of a plane triangle are proportional to the sines of the opposite angles, we can easily compute BC, the side opposite to the angle A, from the following proportion.



$$\sin C : \sin A :: AB : BC$$

Or \sin ang. between bearings : \sin ang. between first bearing and course :: dist. run : x

where x represents the required distance, and may easily be found by attending to the rule in Art. 12.

Ex. Sailing past a lighthouse, at 1 A.M., it bore by compass N 15° W.; at 4 A.M. it bore N 50° W.; the ship in the interval run N 60° E. 6 miles an hour: required the distance of the ship from the lighthouse at 4 A.M.

Angle between bearings = 35°; angle between first bearing and course = 75°; distance run = 18 miles: hence

$$\begin{array}{r} \sin 35^\circ : \sin 75^\circ :: 18 : x \\ 1.255273 \log 18. \\ 9.984944 \log \sin 75. \\ \hline 11.240217 \\ 9.758591 \log \sin 35. \\ \hline 1.481626 \log 30.3 \text{ miles required dist.} \end{array}$$

In a similar manner, if necessary, the ship's distance from a known point at the time of taking the first bearing may be determined.

(56.) Sometimes a ship, in sailing through a tide or current, is carried away by it in the direction in which it runs. And as the log itself, when cast into the sea for the purpose of ascertaining the rate of sailing, must also be swept by the stream in the same direction and with the same velocity, it is manifest that the place of a ship determined by a log account must, in such circumstances, differ from its true place by the whole effect of this stream. For the ship may be considered as a point moving on the top of a table, while the table itself is moved: we have first the motion of the point on the table to account for, and then the motion of the table itself. The proper correction will therefore be found by supposing the ship, in addition to the courses on the log-board, to have sailed through the number of miles passed over by the tide or current.

The course of the tide or current is usually taken by the compass, and must be corrected for variation only.

The actual operation of a day's work will be briefly explained after the following transcripts from a journal, wherein the ship is supposed to take a departure from Cape Finisterre, and to sail for the island of Madeira.

At Noon on Nov. 9, 1835, Cape Finisterre, N. N. E. 15 miles.

1	8		S. W. $\frac{1}{2}$ W.	N. N. W.		P. M. Moderate breezes and fine weather, all sails set.
2	7	8				
3	7	6				At 3, wind shifted to S. S. W. $\frac{3}{4}$ W., down Studding-sails, Rl. and Middle Stay-sails, and braced up on the starboard tack.
4	7	8	S. E. $\frac{3}{4}$ S.	S. S. W. $\frac{3}{4}$ W.		
5	8					
6	8	2				At 4, Do. Wr.
7	8	6				
8	8	6				At 7, fresh breezes and fine Wr., in Royals, down Flying-Jib and Top-gallant Stay-sail, and in second reefs of the Top-sails (Leeway $\frac{1}{2}$).
9	8	8	W. $\frac{3}{4}$ N.	Do.		
10	8	4				
11	8	8				At 8, fresh breezes, tacked ship.
12	8	6				Midnight, Do. weather, tacked ship.

H.	K.	T.	Courses.	Winds.	No. of Signals	Remarks, &c. H. M. S. —, Nov. 10, 1835.
1	8	7	S. E. by S.	S. W. by S.		A.M. Fresh breezes and cloudy.
2	8	5				
3	9	2				
4	9	5				At 4, strong breezes, in Top-gallant-sails and 3d reef of the Top-sails, down outer and set inner Jib, reefed the Spanker, down Royal and Top-gallant-yards, and struck Top-gallant-masts (Leeway $1\frac{1}{2}$).
5	4	3				
	4	3	W. by N. $\frac{1}{2}$ N.	S. W. $\frac{1}{2}$ S.		
6	8	5				At 4.30 tacked ship.
7	8	3				
8	8	5				At 10, strong breezes, down inner Jib, and up Fore-top-mast Stay-sail.
9	8	5				
10	8	3				A Swell the last 6 hours setting the ship S. E. 1 mile an hour. Noon,
11	7	5				Do. weather.
12	7	7				

Course.	Distance.	Latitude in	Longitude in	Bearing and Distance of Funchal.
S. 24° 28' W.	78	41° 45' N.	10° 1' W.	S. 30° 58' W. 639 miles.

1	7	4	S. E.	S. S. W.		P. M. Strong breezes with a heavy head sea.
2	7	2				
3	7	2				At 4, Do. weather, tacked ship.
4	7	3				
5	7	5	W. by S. $\frac{1}{2}$ S.	S. $\frac{1}{2}$ W.		At 5, got the Top-gallant-mast on deck, and Flying Jib-boom in.
6	7	6				
7	7	4				At 6, in 4th reefs of the Top-sails and reefed the Courses, down Spanker and set the Try-sail (Leeway 2).
8	7	6				
9	7	8	E. S. E.	S.		At 8 wore ship.
10	7	8				
11	7	6				Midnight, strong breezes, wore ship.
12	8					

H.	K.	T.	Courses.	Winds.	No. of Signals	Remarks, &c. H. M. S. —, Nov. 11, 1835.
1	7		N. W. by W.	S. W. by W.		A. M. Strong breezes,
2	6					
3	5					At 4 wore ship.
4	5					
5	5	6	S. $\frac{3}{4}$ E.	S.W.b.W. $\frac{1}{4}$ W.		At 6, in Mizzen Top-sail, and set the Mizzen Stay-sail (Leeway 3).
6	5					
7	5	4				
8	5		W. N. W.	S. W.		At 8, Do. Wr. wore ship, in Fore Top-sails (Leeway $3\frac{1}{2}$).
9	5					
10	5					
11	4					Noon, strong breezes.
12	4					
Course.		Distance.	Latitude in	Longitude in	Bearing and Distance of Funchal.	
N. 60° 53' E.		18	41° 54' N.	9° 40' W.	S. 31° 47' W. 655.	
1	4		W. N. W.	S. W.		P. M. Strong breezes and cloudy.
2	3	6				
3	3	2				At 2, fresh gales, up Main-sail, and furled it, set Main Stay-sail (Leeway 4).
4	2	6				
5	1			S. S. W. $\frac{1}{2}$ W.		
6	1		up W. by N.			At 4, strong gales, up Fore-sail, down Fore Top-mast, and set Fore Stay-sail (Leeway 5).
7	1		off N. W. b. W.			
8	1					
9	1	5		S. W. $\frac{1}{2}$ W.		
10	1	5	up W. N. W.			
11	1	5	off N. W.			
12	1	5				Midnight, strong gales and cloudy.
H.	K.	T.	Courses.	Winds.	No. of Signals	Remarks, &c. H. M. S. —, Nov. 12, 1835.
1	1	4	up W. b. N. $\frac{1}{2}$ N.	S. W. by S.		A. M. Do. Wr.
2	1		off N. W. $\frac{1}{2}$ W.			
3	1	2	S. W. $\frac{1}{2}$ W.	N. N. W.		At 2, more moderate, wind shifted to N. N. W., trimmed sails.
4	1	4				
5	6					At 4, fresh breezes and fine, out reefs and made sail.
6	6	4				
7	7					
8	8	2				At 8, Do. Wr.
9	8	4				
10	9					
11	9					
12	8	6				Midnight, fresh breezes and fine.

(57.) In the above journal there is one column for the hours, and two adjoining ones for the knots and tenths of knots, marked K and T. The third column contains the courses, which are put opposite the hour next after the one, when they are begun or changed. In the fourth column is inserted the point from which the wind blows. A fifth column is made in ships of war, for the No. of any signal made. In the last column or space, the public occurrences of the ship are written.

The day is divided, according to the civil mode, into two intervals of twelve hours, the first marked A. M., the latter P. M. It is supposed to begin at midnight, and end at midnight; but the reckoning is worked from noon to noon, and the ship's place settled each day at that time.

(58.) In working the above journal, the variation of the compass will be assumed *one* point and *three-quarters* westerly, or $1\frac{3}{4}$ W. It is usual to insert this, as determined by astronomical observation, in the space for remarks, where the results also of other observations for finding the latitude and longitude are put; but at present we wish to confine ourselves to the log account alone.

(59.) The compass-bearing of Cape Finisterre at starting is N. N. E.; the opposite point to which is S. S. W. Allowing the variation to the left of this, we have the true bearing of the ship from Cape Finisterre S. $\frac{1}{4}$ W., and dist. 15 miles.

(60.) The ship first sails S. W. $\frac{1}{2}$ W. $9\frac{1}{2}$ points from the wind, under all sail. Consequently no leeway is to be allowed. But correcting for the variation, we have the true course S. S. W. $\frac{3}{4}$ W. The distance on this course is 23.4 miles; which is got by adding up the *dist.* columns as far as 3 P. M., when the course is changed.

The second course is S. E. $\frac{3}{4}$ S., six points from the wind, the ship being now close-hauled. It is still however kept under all sail, and therefore no leeway is allowed. The variation 1 P. 3 Q. is allowed to the left, (see mode of correcting courses in Art. 43). Hence the true course is S. E. by E. The distance on this course is 32.6, adding up the distance columns from 4 to 7 P. M., when sail is taken in, and the ship in consequence makes leeway.

(61.) By referring to the general rule for leeway and the column of remarks in the journal, it appears that *half* a point should be allowed for leeway after 7 P. M.; to the left, because the ship is on the starboard tack (Arts. 38 and 39). Allowing therefore first the variation 1 P. 3 Q. to the left and the leeway 2 Q. to the left, the true course becomes S. E. by E. $\frac{1}{2}$ E. The distance is 8.6 miles.

(62.) The two next courses W. $\frac{3}{4}$ N. and S. E. by S. are corrected for variation and leeway as explained in Art. 43. The latter will require a different correction after 4 A. M., because more sail is taken in, and the leeway becomes greater. From this hour therefore to $4\frac{1}{2}$ A. M. we have a distinct true course, namely, E. S. E. (see following form), the distance upon which is the 4.3 miles placed above the cross line drawn at 5 A. M.

(63.) The next course W. by N. $\frac{1}{2}$ N. commences at $4\frac{1}{2}$ P. M., and the distance run includes the 4.3 miles under the cross line. This course is continued to the noon of Nov. 10.

(64.) On referring to the remark column, we find that the ship, in addition to the courses which are put down in the proper column, has been set by a swell 6 miles S. E. This is considered as a distinct compass course (56), and corrected for variation.

(65.) The following is the form in which the different corrected courses and distances are inserted. There is one column for the *true courses*, another for the number of points, which each is from the N. or S.; a third for the *distances* run; and lastly four columns marked N, S, E, W, for the *tr. diff. lat.* and *dep.* made on each course.

	Points from N. or S.	True Course.	Dist.	N. D. Lat.	S. D. Lat.	E. Dep.	W. Dep.
Dep. course ..	S. $\frac{1}{4}$ W.	S. $\frac{1}{4}$ W.	15	—	15.0	—	0.7
	S. $2\frac{3}{4}$ W.	S. S. W. $\frac{3}{4}$ W.	23.4	—	20.1	—	12.0
	S. 5 E.	S. E. by E.	32.6	—	18.1	27.0	—
Sail taken in .	S. $5\frac{1}{2}$ E.	S. E. by E. $\frac{1}{2}$ E.	8.6	—	4.0	7.6	—
	S. $7\frac{1}{2}$ W.	W. $\frac{1}{2}$ S.	34.6	—	3.3	—	34.3
	S. $5\frac{1}{4}$ E.	S. E. by E. $\frac{1}{4}$ E.	35.9	—	18.5	30.9	—
	S. 6 E.	E. S. E.	4.3	—	1.6	4.0	—
	N. 7 W.	W. by N.	61.6	12.0	—	—	60.3
Swell course..	S. $5\frac{3}{4}$ E.	S. E. by E. $\frac{3}{4}$ E.	6	—	2.6	5.4	—
				12.0	83.2	74.9	107.3
					12.0		74.9
					71.2		32.4

(66.) When the courses are corrected, and the distances added up, the number of points which each course is from the N. or S. is put in a separate column, in order that the calculator may open the traverse table with less danger of mistake. With a similar view the columns, in which the *tr. diff. lat.* and *dep.* on each *course* are to be inserted, when taken from the traverse table, are left open, and the others filled up with a dash. Thus, in the first course of the above form, the S. and W. columns are left open, and the N. and E. are marked with a dash.

(67.) In looking for each distance in the traverse table, in order to find the *tr. diff. lat.* and *dep.*, it may be taken to the nearest unit; or, what would be more correct, the integral and decimal parts of the *dist.* may be looked for, where the limits of the traverse table admit of it, as a whole number; care being taken to carry the decimal mark one back in the corresponding *tr. diff. lat.* and *dep.* Thus in the second course of the following form, the *dist.* 23 4 may be looked for as 234, and the corresponding *tr. diff. lat.* 201 and *dep.* 120 written 20.1 and 12.0.

(68.) Having added up the different columns of *tr. diff. lat.* and *dep.* we find that the N. *diff. lat.* is 12, and the S. *diff. lat.* is 83.2. Whence the difference with the name of the greater, or 71.2 S., is the whole *tr. diff. lat.* In like manner 32.4 W. is the whole *dep.*

After getting the numbers we proceed to compute the *course* and *dist.* made good upon the whole, with the *lat. in* and *long. in*, either by logarithms or by a traverse table.

(69.) *By Logarithms and Meridional Parts.*

See Art. 11, proportions (1), (3), (4).

(3)		(1)
11.510545		11.852480
1.852480		9.959138
<hr/>		<hr/>
9.658065		1.893342
Course S. 24° 28' W.		Dist. 78.2 miles.
		(4)
Tr. diff. lat. 1° 11' S.	M.P.	9.658065
Lat. from 42 56 N.....	2858	1.982271
<hr/>		<hr/>
Lat. in 41 45 N.....	2762	1.640336....43'7
<hr/>		
Mer. diff. lat. 96		

Hence *diff. long.* is 0° 44' W., and *long. in* is 10° 1' W., the *long.* of Cape Finisterre being 9° 17' W.

Hence it appears that the *course* from Cape Finisterre during the last 24 hours is, upon the whole, S. 24° 28' W.; the *dist.* is 78.2 miles; the *lat. in* is 41° 45' N.; and the *long. in* is 10° 1' W. These are inserted in the proper spaces at noon on the 10th Nov. (see journal); also the *bearing* and *dist.* of Funchal in Madeira, which is computed as in Art. 13.

(70.) *By Traverse Table and Meridional Parts.*

Judging from the *tr. diff. lat.* 71.2 and *dep.* 32.4, the corresponding *dist.* may be guessed to be about 80 (see Note, Art. 24). It is found by inspection that under a *dist.* 78 and at a *course* 24° *tr. diff. lat.* is 71.3, and *dep.* is 31.7. To the nearest degree therefore the *course* is S. 24° W and the *dist.* is 78 miles.

(71.) *By Logarithms and Middle Latitude.*

The *course* and *dist.* from Cape Finisterre, and *lat. in*, are found as above; half the sum of the *lat. in* and *lat. from* is taken, which is 42° 20' the *mid. lat.*; and then proportion (2), Art. 11, is used as follows.

11.510545	diff. long. 0° 43'.8 W.
9.868785	long. from 9 17 W.
<hr/>	
1.641760....43'.8	long. in 10 1 W.

(72.) *By a Traverse Table and Middle Latitude.*

The *course* and *dist.* are determined as before; then the *diff. long.* is found by looking for the *dep.* 32.4, (or the nearest number we can find thereto) in the *tr. diff. lat.* column at the *course* 42°, see proportion (3) and (4). The corresponding number 44 in the *dist.* column will be the *diff. long.* whence the *long. in* is got as before.

The above are the different methods of finding the *course*, *dist.* *lat. in.* and *long. in.* In addition to this the *bearing* and *dist.* of the place to which the ship is bound, or some other place it is expected to make, are computed as in Art. 13, &c., and entered in the proper space in the log-book at each noon.

Form for the second Day's Work.

	Points from N. or S.	True Course.	Dist.	N.	S.	E.	W.
Sail taken in	S. 7 E.	E. by S.	29.1	—	5.7	28.5	—
	S. 6 W.	W. S. W.	15.1	—	5.8	—	13.9
	S. 6 $\frac{3}{4}$ W.	W. S. W. $\frac{3}{4}$ W.	15.0	—	3.6	—	14.6
	N. 6 $\frac{1}{4}$ E.	E. N. E. $\frac{1}{4}$ E.	31.2	10.5	—	29.4	—
	N. 4 $\frac{3}{4}$ W.	N. W. $\frac{3}{4}$ W.	23.0	13.7	—	—	18.6
Sail taken in	S. 4 $\frac{1}{2}$ E.	S. E. $\frac{1}{2}$ E.	11.6	—	7.4	9.0	—
	S. 5 $\frac{1}{2}$ E.	S. E. by E. $\frac{1}{2}$ E.	10.6	—	5.0	9.3	—
	N. 4 $\frac{1}{4}$ W.	N. W. $\frac{1}{4}$ W.	18.0	12.1	—	—	13.3
				36.3	27.5	76.2	60.4
				27.5		60.4	
				8.8		15.8	

(73.) There is nothing in this day's work which will not be understood by attending to the different steps of the first. The variation is supposed to be the same as before, namely $1\frac{3}{4}$ W.; the leeway is known by referring to the column of remarks, or by comparing the sail on the ship with the general rule in Art. 40.

Form for the third Day's Work.

Points from N. and S.	True Course.	Dist.	N.	S.	E.	W.
N. 4 $\frac{1}{2}$ W.	N. W. $\frac{1}{2}$ W.	7.6	5.1	—	—	5.6
N. 3 $\frac{3}{4}$ W.	N. W. $\frac{1}{4}$ N.	5.8	4.3	—	—	3.9
N. 2 $\frac{3}{4}$ W.	N. N. W. $\frac{3}{4}$ W.	4.0	3.4	—	—	2.1
N. 1 $\frac{3}{4}$ W.	N. by W. $\frac{3}{4}$ W.	6.0	5.6	—	—	2.0
N. 2 $\frac{1}{4}$ W.	N. N. W. $\frac{1}{4}$ W.	2.4	2.2	—	—	1.0
S. 2 $\frac{3}{4}$ W.	S. S. W. $\frac{3}{4}$ W.	65.2	—	55.8	—	33.4

(74.) In the journal of the last 24^h we see that the ship from 4 P.M. to 2 A.M. lay-to on the larboard tack, coming up as near the wind the first four hours, as W. by N., and falling off as far from it as N. W. by W. In this case the middle point W. N. W. is taken, and corrected for variation and leeway; the resulting true course (see above form) is N. N. W. $\frac{3}{4}$ W. A similar method is pursued in finding the compass courses, and thence the true courses for the next four hours.

The other steps of this day's work are similar to those in the first

(75.) Having given the foregoing outline of the mode of keeping a sea journal by the log account, we may conclude this subject by observing that, whenever at sea the latitude of the ship at noon is found from astronomical observation, it is usual to discard the latitude by account and to insert the astronomical latitude in its place, and to use this in computing, as above, the *course*, *dist.*, and *long. in.* When no observations are got for determining the longitude of the ship, such a substitution tends to correct in some degree the log account.

Current Sailing.

(76.) Suppose it were required to pull a boat from A to D in a straight line, a current setting in the intermediate space in the direction BC. Then to keep the boat in the line AD, it is manifest that the boat must be steered along some line AB, which lies against the current; so that if at one pull the boat is propelled (or independently of the current would be propelled) through AB, the current may in the same time carry it through BC, in which case, at the termination of the motion produced by the pull, the boat will be actually in the line AD at C. The lines AB and BC are, as is evident, proportional to the rates of motion of the boat in still water and of the current. Thus, if the boat could be pulled at the rate of 6 miles an hour in still water, and the current run at the rate of 3 miles an hour, $AB : BC :: 6 : 3$. But since the sides of a plane triangle are proportional to the sines of the opposite angles, $AB : BC :: \sin C : \sin A$; where C is the angle between the bearing of D and the direction in which the current runs, and A is the angle between the bearing of D and the bearing on which the boat must be steered. Hence therefore, calling the latter angle x , we have the following proportion:—

Rate of pulling in still water : rate of current :: \sin angle between bearing and current : $\sin x$.

The application of this proportion will be best seen by an example.

Ex. The bearing of a ship is S. S. W. and a current runs west 4 miles an hour: how must a boat be steered to fetch the ship, supposing I can pull in still water 6 miles an hour?

Here the angle between the bearing and the current is 6 points or $67^\circ 30'$; the angle between S. S. W. and the required course is x . Then (see Art. 12.)

$$\begin{array}{rcll}
 6 & : & 4 & :: \sin 67^\circ 30' : \sin x \\
 & & & \hline
 & & & 9.965616 \\
 & & & 0.602060 \\
 & & & \hline
 & & & 10.567676 \\
 & & & 0.778151 \\
 & & & \hline
 x = 38^\circ 1' \text{ or } 3\frac{1}{2} \text{ points} & \dots\dots\dots & \sin x = & 9.789525
 \end{array}$$

Hence allowing $3\frac{1}{2}$ points from S. S. W. against the current, that is, to the left, we get S. by E. $\frac{1}{2}$ E. the course to be steered.

(77.) The rule therefore is this :

RULE. To the *log. sin* of the angle between the given bearing and the set of the current, add the *logarithm* of the rate per hour of the current, and subtract the *logarithm* of the rate per hour of the boat supposing there were *no* current. The remainder will be the *log. sin* of an angle, which find from the tables and express in points. Allow this to the right or left of the given bearing, always against the current. The result will be the course to be steered.

The same rule applies to a ship impelled by the wind on the sails, as well as to boats impelled by the stroke of oars ; only, in ships the rate of sailing will depend on the course to be steered on, and therefore must depend on the angle which it is proposed to compute. However, every seaman is able by practice to estimate this angle nearly ; and then, by considering the strength and direction of the wind, he is able also to estimate nearly the rate of sailing. With this he may, by the rule, compute the angle more exactly, and thence the course to be steered.

(78.) The rate of approach to the point aimed at, that is, the value of AC, may also be easily computed. For, subtracting the sum of the angles CAB and ACB from 180° , the remainder will be ABC. Then, $\sin A : \sin B :: BC : AC$; in which proportion, the three first terms being known, the fourth may be easily computed by the rule in Art. 12.

(79.) If in computing the course to be steered in a current the *log. sin* of the angle A should come out equal to *log. rad* or 10, in that case the vessel must be steered perpendicularly to AC. If the *log. sin* of the angle A should come out greater than *log. rad* or 10, in that case it is impossible, under the circumstances proposed, to keep the boat in the line AD.

(80.) Since, in shaping a course for a vessel in a current, the object is to keep it in the line AD, the bearing of D, as the boat advances towards the point, must remain constantly the same. Which proves the correctness of the rule in practice, namely, that the boat must be so steered, that *the bearing of the object steered for may not alter*.

(81.) The same practical rule applies, when it is required to come up with a vessel itself in motion, in the least time possible. The vessel in chase must be so steered, that the vessel chased may always be kept on the same bearing ; supposing this possible. For the *relative places* of the two vessels will be the same, as if the chasing vessel had the motion of the vessel chased on the opposite bearing, and the latter were actually at rest.

Ex. A ship B bears from another A, S. by W., the wind being North. The ship B is standing on a W. N. W. course at the rate of 8 miles an hour. On what course must A be steered so as to come up with B in the shortest time, the rate of sailing on the *estimated* course being 11 miles an hour ?

The practical rule in this case would be to keep the ship A on the same bearing, namely S. by W. : but the course to be steered may be found by supposing B to be stationary and A to be carried by a current on the opposite point to W. N. W., that is, E. N. E., at the rate of 8 miles an

hour. The angle between the bearing of B and the set of the supposed current will then be 11 points or $123^{\circ} 45'$. Hence, denoting by x the angle between the required course S. by W., we have, by the rule in Art. 76,

$$\begin{array}{r} 9.919846 \\ 0.903090 \\ \hline 10.822936 \\ 1.041393 \\ \hline 9.781543 \end{array}$$

Whence $x = 37^{\circ} 12\frac{1}{2}'$ or $3\frac{1}{4}$ points; which must be allowed against the supposed current, that is, to the right. The required course is therefore S. W. $\frac{1}{4}$ W.

On the foregoing principles is easily deduced the following rule for chasing.

(82.) *Chasing to Leeward.* Close the chase, keeping her on the same bearing as at first; always changing course with her.

(83.) *Chasing to Windward.* When it is possible, close the chase, keeping her on the same bearing as at first. When this is not possible, keeping on the same course with her, fore-reach, till she is a point or two abaft the beam; then tack; and repeat this till you fetch the chase. In the latter case the least time would be lost by fore-reaching till the chase could be closed and kept on a constant bearing on the other tack; but in doing this the distance from her might become too great, and by manœuvring or accident she might escape from a superior ship.

CHAPTER II.

NAUTICAL ASTRONOMY.

Introductory Observations and Definitions.

(84.) BEFORE we give rules for finding the situation of a ship at sea by observations on the heavenly bodies, it is necessary to say something on the places and motions of these bodies, and to explain, as far as is consistent with the object of this treatise, the first principles of Astronomy.

The sun is a central body of great magnitude, giving light and heat to several smaller globular bodies called planets, which move round it in elliptical orbits from west to east, at different distances, and complete their revolutions in different periods of time; the more distant one of these is from the sun, the longer it is in going round. A distinct idea of the motion of each in this respect may be got by carrying in the hand a small ball round a candle in an oval-shaped curve.

The names of the said globular bodies, with the order of their distance from the sun, are as follows:—

Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus or the Georgian.

Between Mars and Jupiter are four other very small ones; namely, Vesta, Juno, Ceres, Pallas. These, on account of their being so small as to be invisible to the naked eye, are called *telescopic planets*.

Each of these bodies, as it describes an orbit round the sun, has a whirling motion round one of its own diameters, also from west to east; in like manner as a small ball may be turned about a needle or wire run through its centre. And these two motions, namely, the one round the sun, and the whirling motion just mentioned, occasion different seasons and alternate changes of day and night. Of these a clear idea may be got by the following simple experiment. Run a needle through the centre or middle of a small ball, as an apple or an orange; incline one end of the needle towards the flame of a candle. By this it will be seen, that the light of the candle shines more directly, and with greater lustre, on the half of the ball inclined towards it, than on the half reclined from it. This excess of light and heat may be called *summer* on that part; and the defect on the other, *winter*. Carry the ball round the candle to the opposite side, keeping the needle parallel to its former position. The side before turned *from* the candle will now be inclined *towards* it; where it was summer before, there will now be winter; and where it was winter, it will now be summer. At the middle points between the two positions just mentioned, as the ball is carried round the candle with the needle always parallel to its first position, neither extremity of the needle will be turned towards the light; the two halves or hemispheres of the ball will be equally illumined.

like the top of an umbrella extended into a concave globular surface, inclose the ball in the middle. By turning the ball round independently of the exterior concave, the same effect will apparently take place as if the exterior concave turned round the needle produced the contrary way, the interior ball having no whirling motion at all. This may be satisfactorily shewn by actually using, as just described, any small ball and an umbrella. But it will be seen also from the annexed figure. The spectator is supposed to be placed at O, on the small sphere $pep'q$, which revolves from left to right round pp' . In consequence of this whirling motion, the celestial concave, $PEP'Q$, will appear to revolve round a line PP' (which is pp' produced) the contrary way, that is, from *east* to *west*. For let $pep'q$ be a section of the earth passing through p and p' , and through O the place of the spectator, and let $pep'q$ be supposed to be extended into the circle $PEP'Q$ on the celestial concave. Then as $pep'q$ revolves from left to right (or from west to east), $PEP'Q$ must revolve with it, and would really pass through the heavenly bodies X, Y, V, T, &c., successively; but as the spectator passes on with the same angular velocity round PP' that $PEP'Q$ does, he is not sensible of this motion in $PEP'Q$, but is led to imagine that the motion is in X, Y, V, T, &c., the contrary way; and as P and P' are stationary, each of these bodies must keep constantly the same distance from these points: in other words, they must appear to describe circles, some greater and some smaller, but all in the same time (24 hours), round these points or poles; which is exactly what they would do, if placed on the celestial concave revolving round PP' from *east* to *west*.

Bodies seen near P or P' will describe small circles, and appear to move slowly: those seen near E or Q will describe large ones, and appear to move more rapidly.

(85.) In the above articles, the heavenly bodies have been supposed to be situated on the surface of the celestial concave; but they only appear so: for in fact they are situated at different distances from the spectator, and thus interspersed in infinite space. We imagine them to be equally distant from us, because we have no means of estimating by the eye their relative distance; in like manner as we suppose lights in the night to be at equal distances, though one may be 100 yards from us, and another a mile or two. The greatest part of the shining bodies we thus see on the celestial concave preserve constantly the same situation with respect to each other, and are thence called *fixed stars*. Several others appear to change their places among the fixed stars: these are the sun, the moon, the planets (or bodies moving round the sun like the earth), and comets*. Their apparent motion depends on their own real motion, and also on that of the earth from which they are viewed. The sun seems to describe a great circle in the course of a year among the fixed stars; this is owing entirely to the real motion of the earth round the sun in that time, at a distance of about 94 millions of miles: the moon is seen to describe an orbit among the fixed stars, round the earth, in a month; and it really moves round the earth in an elliptic orbit in that time, at the distance of 240 thousand

* Comets are bodies which seem to consist of vapour with a denser nucleus in the middle thereof, and describe round the sun very excentric orbits, that is, very narrow elliptic orbits. At one extremity of such orbits, they approach very near to the sun, and at the other pass off to a very great distance.

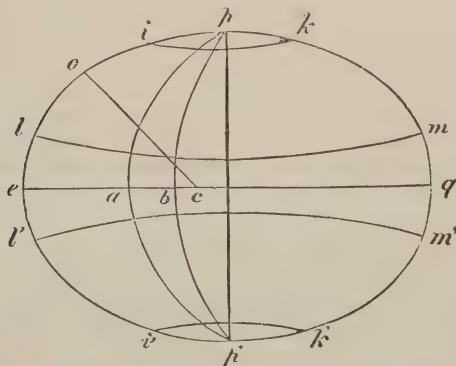
miles. The planets have irregular motions, sometimes progressive, sometimes retrograde, among the fixed stars; and they are sometimes stationary. This is owing to their real motion round the sun, and to that of the earth with them round the same central body. Thus an apparent motion in them is caused by the earth's motion, and another by their own real motion. These are sometimes in the same direction, and sometimes in opposite directions, which accounts for the irregularity just mentioned.

After the above general observations, it will be proper to give the principal definitions used in Astronomy.

Definitions.

(86.) The *axis* of the earth is that diameter round which it revolves every twenty-four hours, from west through south (Art. 5) to east. Thus pp' may be considered as the axis of the earth $pep'q$.

The extremities of this axis on the surface of the earth are called the poles of the earth: thus p and p' are the poles of $pep'q$.



(87.) That great circle on the surface of the earth, which is equidistant from each pole, and cuts the earth into two equal parts, is called the *terrestrial equator*. This is represented by eq .

The axis of the earth is manifestly perpendicular to the terrestrial equator.

The earth has been supposed to be a sphere in the preceding general observations; but by its whirling motion, the parts near the equator, which have the greatest velocity, acquire thereby a greater distance from the centre than the parts near the poles, which have a less velocity in turning round the axis. In consequence of which, the earth assumes the shape of the annexed figure; eq being the equator, and p and p' the poles. The curvature towards p and p' is less than towards e and q (see *App. 3*).

(88.) Sections of the earth passing through the axis pp' , as pap' , pbp' , &c., are called *Meridians*. They are denominated frequently from places through which they pass: thus, if Greenwich be situated on the meridian pap' , this is called the meridian of Greenwich. The arc of the equator or the angle at the pole between the meridian of Greenwich and the

meridian of any other place is called the *longitude* of that place. Thus ab or the angle apb is the longitude of any place on the meridian pbp' .

Longitude is reckoned both ways from a , that is, both to the east and west. Thus one place is said to be in the longitude of 20° E., and another in that of 20° W.

(89.) If a perpendicular be drawn to the surface of the earth where the spectator stands, and produced to cut the plane of the equator, the angle it makes with the equator is called the *latitude*. Thus, let o be any place and oc the perpendicular cutting the equator at c ; then the angle oce is the latitude of o .

Since the surface at o is in a slight degree more curved than the surface towards p , the point c will not be exactly in the centre of the earth; neither will the arc oe be exactly circular so as to measure the angle oce . It is usual, however, in general language, to consider oe as a circular arc; and the *latitude* of any place is said to be the arc of the meridian of that place, intercepted between the place and the equator (see *App.* 4).

Supposing co and ce be produced to cut the celestial concave, as in *Z* and *E* (fig. Art. 84), the circular arc *ZE* would measure the angle at c , and would therefore be strictly the latitude of o , considering the earth as it really is, a *spheroid*. If a straight line were drawn from the centre of the figure (Art. 86) to o , and produced so as to cut the celestial concave in some point as Z' , then *ZE* would be called the latitude of o on the *sphere*; since, supposing the figure to be a sphere, the line joining o and the centre would be perpendicular to the surface at o : this is called the *reduced latitude*, being less than the true latitude by a small quantity called the *reduction* (see *App.* 3, 4).

(90.) Sections of the earth parallel to the equator are called *parallels of latitude*. Such sections are supposed to be circular. Thus ik , lm , are parallels of latitude north of the equator; and $i'k'$, $l'm'$, are parallels of latitude south of the equator.

Two parallels of latitude, one on each side of the equator at the distance of about $23^\circ 27'$, are called *tropical circles*: these may be represented by lm , $l'm'$. Two others at the same distance from the poles, as ik and $i'k'$, are called *polar circles*.

(91.) These four parallels divide the surface of the earth into five zones, namely, the torrid zone, the two temperate zones, and the two frigid zones. The torrid zone lies between the tropical circles lm and $l'm'$; the temperate zones lie between the tropical and polar circles, as between lm and ik , and between $l'm'$ and $i'k'$; the frigid zones lie towards the poles within the polar circles.

(92.) The celestial concave or surface, in which the fixed stars and all the heavenly bodies are seen, is supposed to be at such a distance from the spectator, that two straight lines drawn to the same point therein from any places of two spectators make no sensible angle there. Such lines, therefore, may be considered as parallels. The nearest fixed stars are, in reality, at such a distance from the earth, that lines drawn to any one of them from opposite points of the earth's orbit have no sensible inclination. This has been determined by accurate observations. Also straight lines actually parallel to each other, drawn from any places of two spectators, may be considered as meeting in a point on the same spherical concave.

(93.) The *axis of the heavens* is the axis of the earth, produced both ways to the celestial concave. That extremity of it which is towards the north pole of the earth is called the north pole of the heavens: the other is called the south pole. Thus in the figure Art. 84, PP' is the axis of the heavens, P and P' the north and south poles.

The earth, in describing its orbit round the sun, keeps its axis always in the same position or parallel to itself. Consequently this axis **must** always cut the celestial concave in the same points (92).

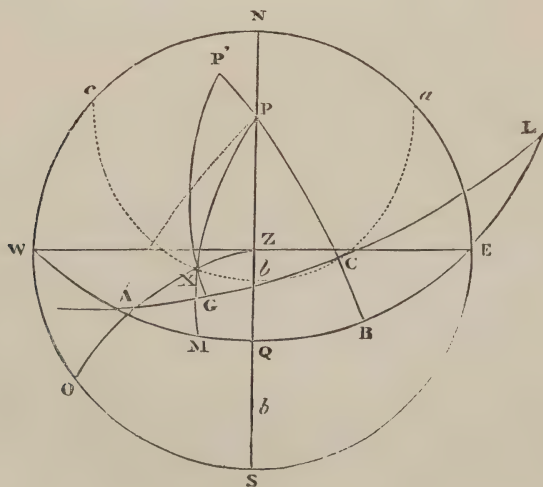
This is independent of a slight deviation from parallelism in the axis of the earth, which will be noticed hereafter.

(94.) The terrestrial equator extended to the celestial concave is called the *celestial equator*. In the figure Art. 84, eq represents the terrestrial equator, and EQ the celestial equator.

The earth in describing its orbit round the sun keeps the terrestrial equator always parallel to itself; consequently the circle which is formed on the celestial concave, by the extension of the earth's equator, must be always the same, and may therefore be considered as a permanent circle on the celestial concave.

This also is independent of slight deviations to be noticed hereafter.

(95.) In consequence of the earth's actual motion round the sun in the same plane, the **sun appears** to describe a circle on the celestial concave; and as the circle is in the **same plane** with the earth, it must be a great circle. This circle is called the *ecliptic*: it is represented in the figure by ACL .



The ecliptic is inclined to the equator at an angle, as determined by observation, of about $23^{\circ} 27'$; and these two circles cut each other at two opposite points: one near the constellation, or cluster of stars, Aries, and

thence called the *first point of Aries*; the other near the constellation *Libra*, and thence called the *first point of Libra*.

Let *ABL* be half the celestial equator, and *ACL* the corresponding half of the ecliptic, *A* the first point of Aries, and *L* the first point of *Libra*. Let *AB* and *AC* be respectively half *ABL* and *ACL*, or quadrants. Then a great circle *BC* must be perpendicular to *ABL* and *ACL*, and must pass through the poles of both. Let *P* be the pole of the celestial equator, and *P'* that of the ecliptic. Then since *PB* is a quadrant, and also *P'C* is a quadrant, it is manifest, by taking the common part *PC* from each, that the remainders *PP'* and *BC* must be equal.

Also *BC* measures the angle *A* (about $23^{\circ} 27'$); consequently *PP'* measures it also, or is the same number of degrees, minutes, &c., as angle *A*.

Let *X* be the place on the celestial concave, where any heavenly body is seen; *PXM*, *P'XG* great circles cutting the celestial equator and the ecliptic in *M* and *G*. Then *XM* is called the *declination* of the body, and *AM* or angle *APM* its *right ascension* (marked *R.A.*); *XG* is called the *latitude* of the body, and *AG* its *longitude*.

(96.) Hence great circles passing through the pole of the heavens are called *circles of declination*; and great circles passing through the pole of the ecliptic are called *circles of latitude*.

Small circles parallel to the celestial equator are called *parallels of declination*. Small circles parallel to the ecliptic are called *parallels of latitude*.

(97.) The *declination* and *right ascension* of a heavenly body may be defined thus:—

The *declination* of a heavenly body is the arc of the circle of declination passing through its place in the celestial concave, intercepted between this place and the celestial equator. The *right ascension* (*R.A.*) of a heavenly body is the arc of the celestial equator measured from the first point of Aries to the circle of declination passing through the place of the body in the celestial concave: or it is the angle at the pole between the equinoctial colure (see Art. 100) and the circle of declination passing through the body's place—measuring round the equator or the pole in the direction of from west through south to east.

(98.) The *latitude* and *longitude* of a heavenly body may be defined as follows:—

The *latitude* of a heavenly body is the arc of a circle of latitude passing through its place in the celestial concave, intercepted between this place and the ecliptic. The *longitude* of a heavenly body is the arc of the ecliptic intercepted between the first point of Aries and the circle of latitude passing through the place of the body—measuring on the ecliptic from west through south to east, or in direction of the earth's motion round the sun.

(99.) The zone which extends 8° on each side of the ecliptic, is called the *zodiac*. In this zone nearly all the planets appear to make their revolutions among the fixed stars. The *zodiac* is supposed to be divided into twelve equal parts, each extending 30° on the ecliptic. These parts

are called *signs*, and are denominated from constellations or clusters of stars, which lie near them. They begin at the first point of Aries, and are as follows :—

North of the Celestial Equator.

No.....	1	2	3	4	5	6
Name....	Aries.	Taurus.	Gemini.	Cancer.	Leo.	Virgo.
Character.	♈	♉	♊	♋	♌	♍

South of the Celestial Equator.

No.....	7	8	9	10	11	12
Name....	Libra.	Scorpio.	Sagittarius.	Capricornus.	Aquarius.	Pisces.
Character.	♎	♏	♐	♑	♒	♓

Each quadrant of the ecliptic must contain three signs, so that the point which is the farthest north from the celestial equator is the commencement or first point of *Cancer*; and the point farthest to the south of the celestial equator, for a similar reason, must be the first point of *Capricorn*. These points are called *solstices* or stationary points of the sun, because here the sun appears neither to advance to the north nor south.

(100.) The circle of declination which passes through the first points of Aries and Libra, that is, through the intersections of the ecliptic with the celestial equator, is called the *equinoctial colure*. The circle of declination which passes through the first points of Cancer and Capricorn, and consequently through the pole of the equator and that of the ecliptic, is called the *solstitial colure*.

(101.) The two parallels of declination which pass through the first point of Cancer and that of Capricorn are called *tropical circles*; the two parallels of declination, at the same distance from the poles of the heavens which the tropical circles are from the celestial equator, are called the *polar circles*. They pass through the poles of the ecliptic, which are at this distance from the poles of the heavens.

(102.) A circle touching the earth where the spectator stands, and extending to the celestial concave, is called the *visible horizon*. This is represented in fig. Art 84, by the line touching the earth at O, and supposed to be produced both ways to the celestial concave.

A circle parallel to the visible horizon, which passes through the centre of the earth, and extends to the celestial concave, is called the *rational horizon*. Thus in the fig. HCR, Art. 84, represents the rational horizon.

These two circles, as is manifest from the observations in Art. 92, form one and the same circumference on the celestial concave. Wherefore either of them is to be understood by the word *horizon*, in speaking of the situation of points on the celestial concave.

(103.) If a perpendicular to the visible horizon be erected at the spot where the spectator stands on the earth, and be produced both ways upwards and downwards, so as to cut the celestial concave in two points, the point above the spectator, that is, over his head, is called the *zenith*; that downwards in the invisible celestial concave is called the *nadir*.

In fig. Art. 84, O is the place of the spectator on the earth's surface, OZ is supposed perpendicular to the visible horizon at O, or to the rational horizon HR, and cuts the concave sphere upwards at Z; then Z is the zenith of O. If ZO were produced downwards through the earth to cut the celestial concave, we should have the nadir.

When the spectator stands at the pole of the earth, the zenith and nadir will evidently coincide with the poles of the heavens; when the spectator is at the terrestrial equator, the zenith and nadir must be in the celestial equator; when he is at any intermediate point between the terrestrial pole and equator, the zenith and nadir will be situated between the celestial poles and the celestial equator, as in fig. Art. 84.

(104.) It is usual to describe a circle to represent the visible or rational horizon (fig. Art. 95), as NWSE, and to take the centre Z to represent the place of the spectator and also the zenith of that place. The zenith is in fact in the celestial concave immediately over the spectator, but for the facility of construction it is put down on the circle itself, at the point which is truly the place of the spectator. Let the pole of the heavens be also represented on the same circle by P: draw PZ, and produce it to cut the horizon at N. and S. Then the line NPZS will represent the line RPZH in fig. Art. 84.

Since NPZS passes both through Z, the pole of the horizon, and through P, the pole of the celestial equator, both these latter circles must be perpendicular to NPZS, and consequently their points of intersection must be 90° from NPZS. Let therefore W and E be each 90° from S; then the representation of the celestial equator must pass through W and E. Let this representation be EQW cutting NPZS in Q. Then ZQ will be the same as ZE in fig. Art. 84, PZ the same as PZ in fig. Art. 84, and PN the same as PR in fig. Art. 84: that is, ZQ will be the *latitude* of the place where the spectator stands on the surface of the earth; PZ being the complement of ZQ, will be the *colatitude*. Also PN will be the altitude of the pole above the horizon. And since NZ is 90° , PZ is the complement of PN: but PZ is also the complement of ZQ; wherefore PN is equal to ZQ, that is, PN is the latitude of the place of the spectator.

The circle represented by NPZS, which passes through Z the zenith and P the pole of the heavens, is called the *celestial meridian*. It cuts the horizon at two opposite points. That point which lies towards the north pole (which we may suppose P to be) is the *north*, and marked N.; the other which is towards the south pole is the *south*, and marked S.

If the spectator on the surface of the earth look to the south, he sees the heavenly bodies rising above the horizon on the left, and setting on the right. That point of the horizon which is 90° from the north and south towards the left or rising of the heavenly bodies, is the *east*, and marked E.: that point on the horizon which is 90° from the north and south towards the right or setting of the heavenly bodies, is the *west*, and marked W. Hence it is manifest that W. and E. (fig. Art. 95) are the West and East points.

It is evident that the west point is opposite to the east, so that a great

circle passing through the zenith and one of these points passes also through the other. Such a circle as WZE is called the *prime vertical*.

Let X be the place of a heavenly body in the celestial concave, and let a great circle passing through the zenith Z and the place of the body at X cut the horizon at O: then XO is called the *altitude* of the body; NO or SO is called the *azimuth* of the body.

Hence great circles passing through the zenith are called *circles of altitude* or *vertical circles*; and the altitude and azimuth of a heavenly body may be defined as in the following articles.

(105.) The *altitude* of a heavenly body is the arc of a circle of altitude intercepted between the place of the body in the celestial concave and the horizon. The *azimuth* is the arc of the horizon intercepted between the north or south point, and the circle of altitude passing through the place of the body: or it is the corresponding angle at the zenith between the celestial meridian and the circle of altitude passing through the place of the body.

The *amplitude* of a heavenly body is the distance from the east at which it rises, or the distance from the west at which it sets; these distances or arcs being measured on the horizon: or it is the corresponding angle at the zenith between the prime vertical and the circle of altitude passing through the place of the body.

(106.) It will be of great use to the student, before he proceed farther, to represent on such a figure as in Art. 95 as many of the arcs as possible which have been defined above, under different circumstances with respect to the latitude of the place he is supposed to stand at, as well as to the situation in the celestial concave of the heavenly body. It will be of still greater use to him to compare the figure when completed with the celestial globe, adjusted to the latitude of the place by raising the pole to an altitude equal to the latitude; putting a small piece of wetted paper at a spot on the globe corresponding nearly to the place assumed for X in the figure, in right ascension and declination.

Apparent Time, Mean Time, and Sidereal Time.

(107.) As the earth turns round its axis from west to east, we may suppose the celestial meridian of any place on its surface to revolve with it. Thus let *pep'* (Art. 84) be the meridian of any place on the surface of the earth, and PEP' the corresponding celestial meridian. As *pep'* revolves round the terrestrial axis *pp'*, let PEP' revolve in the same direction, that is, from E towards Q, round PP' the axis of the heavens. Then PEP' in this revolving will pass through heavenly bodies, as A, B, G, &c., in order, from west to east; and after describing or tracing out the whole celestial concave round PP', the celestial meridian will return to the same position as at first, namely, PEP'.

Instead of supposing the celestial meridian thus to revolve round the axis of the heavens eastward, to pass the circle of declination of any heavenly body, as the sun, and make greater and greater angles with it at the pole, we may suppose the celestial meridian of the place to be fixed, and the circle of declination of the heavenly body to revolve with the body westward, increasing the polar angle as before. This supposition will perhaps be more convenient in giving easy definitions of *apparent time*, *mean time*, and *sidereal time*.

(108.) *Apparent Time* is the polar angle (in time*) described westward from the celestial meridian of the place by the circle of declination passing through the centre of the *true* sun.

(109.) *Mean Time* is the polar angle (in time*) described westward from the celestial meridian of the place by the circle of declination passing through the *mean* sun.

(110.) The *true* sun is that which is seen by the eye. Its motion from west to east in right ascension is variable, so that the intervals of different complete revolutions of the circle of declination passing through it, *from* the celestial meridian to the celestial meridian again, are unequal. The unequal intervals are called *apparent solar days*. They begin and end when the true sun's centre is on the meridian. The *mean* sun is an imaginary sun, moving uniformly from west to east in right ascension with the mean or average motion of the *true* sun, and beginning its course along the celestial equator at a particular period.

The motion of the *mean* sun in right ascension or in polar angle being uniform, it follows that the different intervals of complete revolutions of the circle of declination passing through it from celestial meridian to celestial meridian again must be equal. These equal intervals are called *mean solar days*. They begin and end when the mean sun's centre is on the meridian.

(111.) The *equation of time* is the difference between apparent time and mean time. It amounts at most to about 16 minutes, and is nothing four times in the year.

(112.) *Sidereal Time* is the polar angle (in time*) described westward *from* the celestial meridian of the place by the circle of declination passing through the *first point of Aries* or the equinoctial colure, Art. 100.

A *sidereal day* is the interval in which the equinoctial colure makes a complete revolution westward from the celestial meridian to the celestial meridian again. It begins and ends when the first point of Aries is on the meridian.

(113.) In fig. Art. 84, if B be the true sun, D' the mean sun, A the first point of Aries, and PT the celestial meridian of the place, the angle BPT (in time) will be *apparent time*, D'PT (in time) will be *mean time*, and APT (in time) will be *sidereal time*. Here the left-hand side of the figure is supposed to be the west, and the right-hand side the east.

By inspecting the figure, it is evident that sidereal time is the same as the right ascension of the meridian: for the angle APT is in fig. Art. 84 the right ascension of the meridian PT (see Art. 97).

It thus appears also that *sid. time* = *app. time* + *true sun's R.A.* (in time); and that *sid. time* = *mean time* + *mean sun's R.A.* (in time). For angle APT = BPT + APB, and also APT = D'PT + APD'.

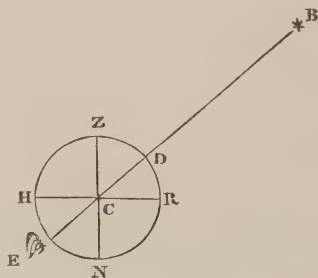
* An angle or arc is expressed in time by allowing 24^h for 360°; that is, 1^h for 15°; ^m for 15'; 1° for 15'', and so on in proportion. When an angle or arc is thus expressed, it is said to be *in time*; when expressed in ° ' '' it is said to be *in arc*. One may be turned into the other very readily by means of the Table of *Log. Haversines* (see *Naut. Tables*).

If the sum be greater than 24^h , then 24^h must be rejected: this will appear manifest by constructing a figure to suit such a case. (See *App.* 12.)

(114.) *Apparent time* is shewn by a *sun-dial*; which, when the true sun's centre is on the celestial meridian of the place, throws the shadow of the stile on 0^h or 12^h . *Mean time* is shewn by a clock or watch properly adjusted to go 24^h uniformly in a mean solar day, and to begin from 0 when the centre of the mean sun is on the celestial meridian. *Sidereal time* is shewn by a clock or watch adjusted to go uniformly 24^h in a sidereal day, and to begin from 0 when the first point of Aries is on the meridian.

(115.) The *Hour Angle* of a heavenly body is the angle at the pole (measured west or east) between the celestial meridian and the circle of declination passing through the place of the body: thus in fig. Art. 95 ZPX is the hour angle of X, and ZPC is the hour angle of C.

(116.) The transit of a heavenly body over the celestial meridian, or of the celestial meridian through the body, has been mentioned in the foregoing observations: it may not be amiss to say a few words here on the method of ascertaining this transit. Let a thin circular board ZHNR be supposed to be placed in the plane of the celestial meridian at the place of the spectator, and a vertical and horizontal line ZN and HR to be drawn upon it. Let the spectator's



eye be placed at E on the edge of the board, and his view be directed along the surface of the board in the line ECD. This circular board placed in the plane of the meridian would revolve with the earth; and to the eye at E a heavenly body B would be seen passing the edge of the board as at D, when it passed the celestial meridian. And thus by shifting the eye round the semicircle HNR, the transit of every heavenly body above the horizon might be observed. And not only the time of the meridian transit might be taken, but also the altitude above the horizon: for, supposing the edge of the board to be graduated, DR would be the meridian altitude at which B would pass; also ZD would be the meridian zenith distance.

The circular board, instead of being placed in the plane of the celestial meridian, may be supposed to be placed in the plane of any circle of altitude whatever, in which case DR would be the altitude of B.

Let now ED be supposed to be a telescope lying on the flat side of a brass circular instrument. Let a fine wire be fixed within this telescope parallel to the said flat side, and be distinctly visible to an eye at E. Suppose that the circle can be turned in its own plane round a *horizontal axis* passing through C perpendicularly to the paper, and let the telescope be capable either of being fastened to the circle so as to turn with it, or of being unfastened and turned round the same horizontal axis independently of the circle.

The wire in the telescope, and the axis or middle line of the telescope (supposed to pass through the wire), are adjusted so as to be exactly parallel to the plane of the circle, and at the same time so as to be constantly in the plane of the celestial meridian, as the telescope is turned round.

The rim of the circle is graduated, so that the position of the axis of the telescope is known by observing the place of an index attached to the eye end and lying close to the said rim. The wire represents any portion of the celestial meridian to which it is directed; so that, when a heavenly body as a star is seen on the wire, it is known to be on the celestial meridian: the index on the rim of the circle shewing at the same time its meridian altitude or its meridian zenith distance.

A telescope by itself without the circle, adjusted as above, is called a *transit telescope*. Such a one is used *only* for taking the meridian transits of heavenly bodies. When a graduated circle is added, the instrument is more especially used for measuring meridian altitudes or meridian zenith distances. These two instruments, together with a clock going according to sidereal time (112), form the main instruments in an observatory on shore.

In some cases the whole combined instrument, or circle and telescope, is constructed and adjusted so as to turn also round a vertical axis, and thus the wire may be brought not only into the plane of the meridian, but also into the plane of any circle of altitude whatever. By means of such an instrument both the azimuth (105) and altitude (104) of a heavenly body may be observed at the same instant.

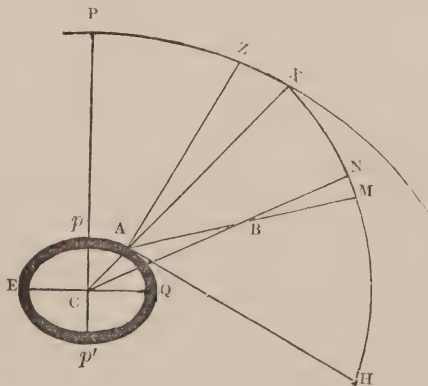
Parallax and Refraction.

(117.) The place of a heavenly body as seen, or rather supposed to be seen, from the centre of the earth, is called its *true place*; thus the altitude of the moon, its right ascension, declination, &c., seen from thence, are called the true altitude, the true right ascension, and true declination of the moon. Again, the place of a heavenly body as seen from any point on the earth's surface is called its *apparent place*. Thus the altitude of the moon, its right ascension, declination, &c., seen from the earth's surface, are called its apparent altitude, apparent right ascension, apparent declination, &c.

The true and apparent places of a heavenly body differ on account of *parallax* and *refraction*.

*Diurnal Parallax.**

(118.) *Diurnal Parallax* is the arc on the celestial concave between the place of any heavenly body as seen from the surface of the earth and its place as seen from the centre, supposing no refraction to exist. Let $pEpQ$ be the earth, C its centre, A the place of the spectator on the surface, and B any heavenly body. Then, on the supposition that rays of light coming from B pass to A and C in straight lines, the spectator at C would



see B in the celestial concave at N ; the spectator at A would see it at another place M . The arc of a great circle between M and N , or the angle

* The arc between the places of a heavenly body, as seen from opposite points of the earth's orbit round the sun, is called *annual parallax*.

MBN or ABC, which MN measures, is called the *diurnal parallax* of B. Let CA the radius of the earth, when produced, cut the celestial concave in X which is called the *reduced zenith*, and let the polar radius of the earth, when produced, cut it in P, which is the pole of the heavens. Then, since the great circle passing through M and N must pass through AB and BC, it must also pass through CAX, and therefore through X. That is, diurnal parallax MN lies in a great circle XNM, and the apparent place (as far as diurnal parallax is concerned) is farther from X than the true place is, by MN.

Let CB, the distance of B from the centre of the earth, be denoted by d ; CA a radius of the earth by r ; the diurnal parallax MN or angle ABC by p ; the arc XN or angle XCN, that is, the *true reduced zenith distance* by z' ; and the arc XM or angle XAM, that is, the *apparent reduced zenith distance*, by z . Then $p = z - z'$: and $\frac{r}{d} = \frac{\sin ABC}{\sin CAB} = \frac{\sin ABC}{\sin XAM} = \frac{\sin p}{\sin z} = \frac{\sin (z - z')}{\sin z}$. Now, the value of p , when the body appears in the horizon, or $z = 90^\circ$, is called the *horizontal parallax*, which may be denoted by H. Hence, since in this case $\sin z = 1$, we have

$$\sin H = \frac{r}{d} = (\text{generally}) \frac{\sin p}{\sin z} = \frac{\sin (z - z')}{\sin z} \quad \dots \quad (1)$$

$$\text{consequently } \sin (z - z') = \sin H \sin z \quad \dots \quad (2)$$

If for $\sin p$, $\sin H$, $\sin (z - z')$, which are small, $p'' \sin 1''$, $H'' \sin 1''$, $(z - z')'' \sin 1''$, be severally substituted; p , H , and $(z - z')$ being expressed in seconds of arc; and then the resulting equations be divided by $\sin 1''$; we have

$$H'' = \frac{r}{d} \cdot \frac{1}{\sin 1''}; \quad H'' = \frac{p''}{\sin z}; \quad p'' = H'' \sin z;$$

$$H'' = \frac{(z - z')''}{\sin z}; \quad (z - z')'' = H'' \sin z \quad \dots \quad (3)$$

The above equations at (1), (2), (3) will be very nearly true, supposing X to be the *true zenith*, that is, the zenith on the earth considered as a spheroid: in other words, supposing XAC to be perpendicular to the surface of such spheroid at A.

(119.) Let AZ be perpendicular to the surface of the earth at A, and let it cut the celestial concave in Z, which is the *true zenith*. Then Z must be near X, since the earth is *nearly* a sphere. Moreover, since the earth is considered as a regular spheroidal body, having the flatter part of its surface towards the pole, AZ must be in the plane of the meridian CPX, and Z must be nearer to P than X. In most nautical questions X may be considered as the true zenith Z; in some computations, however, this cannot be done, as in determining the longitude by occultations, &c.

(120.) The arc PZ is the colatitude on the spheroid, and PX is the colatitude on the sphere whose radius is CA. It is usual to call the latitude on the spheroid, that is, the angle *oce* (fig. Art. 86), or the complement of PZ (Art. 95), the *true latitude*; and to call the latitude on the sphere whose radius is CA, that is, the complement of PX, the *reduced*

latitude. When it is necessary in particular computations to use the *reduced latitude*, it is got from the true latitude by subtracting the arc ZX, called the *reduction*, therefrom ; which reduction is known supposing the figure of the earth to be known. (See *App.* 4.)

(121.) The *horizontal parallax* of a heavenly body, that is, its diurnal parallax, when its app. zen. dist. independently of refraction is 90° , is determined by particular astronomical observations at different points of the earth's surface. For any other app. zen. dist. it is computed from the equation $p'' = H'' \sin z$ (Art. 118, (3)), where $p'' =$ diurnal parallax, $H'' =$ hor. par., and $z =$ app. zen. dist. The results are inserted in tables, from which they may be taken by inspection for any given app. zen. dist. or any given app. alt. They are generally, for the purposes of navigation, combined with the effects of refraction in altering the altitude of a body, so that the combined effect of both may be taken out of the tables at once (see Naut. Tables (*m*) and (*w*)).

(122.) From first formula at (3), namely, $H'' = \frac{r}{d} \cdot \frac{1}{\sin 1''}$, it appears (supposing the distance of a heavenly body to remain unchanged) that the horizontal parallax H must be the greatest where the radius of the earth or r is the greatest, which is at the earth's equator;* and that it must diminish continually as the observer changes his place from the equator towards the pole, because the radius of the earth or r does so ; at the pole r is the least, consequently the horizontal parallax of a heavenly body at a given distance is also the least there. The polar horizontal parallax for the moon is about $12''$ less than the equatorial horizontal parallax. What the hor. parallax at any place is less than the equatorial hor. parallax is called the *reduction*. (See *App.* 5.)

It appears also from the same formula, when r is considered as given, or for a fixed point on the earth's surface, that, the less the distance of a heavenly body or of d , the greater must be the value of H the horizontal parallax ; and the greater d is, the less is the horizontal parallax. Thus the horizontal parallax of the moon is greater than that of any other heavenly body, because the moon is the nearest body to the earth. For a fixed star, which is at an immeasurable distance from the earth, the horizontal parallax is insensible.

The horizontal parallax of the moon alters its value, since the moon's distance is variable. At the nearest approach of the moon it is about $61' 29''$. When the moon is farthest from the earth it is about $53' 50''$. The sun's horizontal parallax also changes in a slight degree, for a similar reason.

From the third of the formulæ at (3), namely $p'' = H'' \sin z$, it appears that, if we suppose H to be the same or unchanged, the diurnal parallax or parallax in altitude will be the greatest when the apparent zenith distance or $z = 90^\circ$, because then $\sin z$ is the greatest ; and it will diminish as the apparent zenith distance diminishes, or the apparent altitude increases, because $\sin z$ thus becomes less and less. When the zenith distance is 0, or the body appears in the zenith, $\sin z = 0$, and the parallax in altitude is nothing.

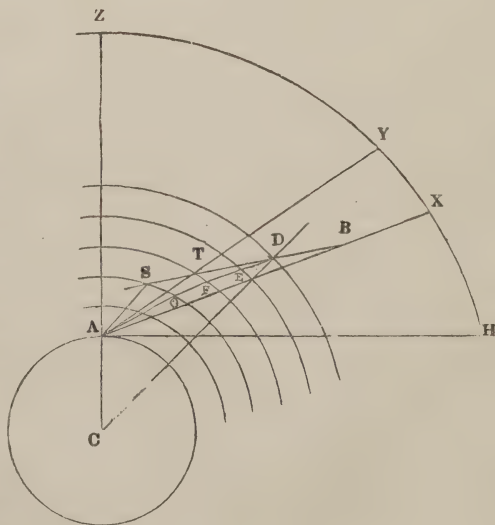
* The *equatorial* hor. par. is put down in the Naut. Almanac, and, in strictness, should always be diminished by reduction in Naut. Table (*g*).

Refraction. (See App. 6.)

(123.) In the above observations on diurnal parallax, rays of light by which vision is produced have been supposed to come from a heavenly body to the eye of a spectator in straight lines, and the difference in the place of a body, as seen from the surface and centre of the earth, has been supposed to arise only from difference of situation in the observer. And under this partial view of the subject, the terms *apparent* place and *true* place have been used. But in fact rays of light do not always proceed in straight lines: for when they pass into the atmosphere of the earth obliquely, in their transit to the spectator on the earth's surface, their direction is in a slight degree changed, and the more so the farther they penetrate the atmosphere; so that, in entering the spectator's eye after these deviations, each makes an impression in a different direction from a straight line drawn to the true place of the heavenly body. The consequence is, that the apparent place of the body is changed, when thus seen from the surface of the earth. But rays of light passing from the heavenly body to the centre of the earth enter the earth's atmosphere perpendicularly, in which case they pass through it without varying their direction at all. No change, therefore, is made by the earth's atmosphere in the place of the heavenly body as seen from the earth's centre.

The change produced on the apparent place of the body by the earth's atmosphere is called *refraction*.

(124.) Let the atmosphere of the earth be represented by the space between two concentric circles A and D; and let this space be supposed to be divided into any number of concentric laminæ by the intermediate concentric circles E, F, &c. Let the air in the first lamina between D and E be considered as of uniform density; let that between E and F be also of uniform density, but, from the pressure of the superior lamina, of greater density than the former. And thus let the interposed laminæ go on increasing in density to the surface of the earth at A.



Suppose now a ray of light from the heavenly body B to enter the atmosphere at D, making at that point an acute angle with its surface towards the horizon AH, and an obtuse angle with it towards the zenith Z. Then it is well known, from the principles of optics, that this ray, after entering the surface at D, will move on in a direction as DE, making a

larger acute angle than before with the surface of the fluid, and a smaller obtuse angle on the other side. A similar effect will be produced at E, where the ray enters the second lamina of increased density; at F, where it enters the third; and so on, till it arrives at A, the place of the spectator.

It is evident, therefore, that the ray will enter the eye of the spectator at A, in a direction more approaching to a vertical line than a ray from the body would have done, if no atmosphere had existed: that is, the body will appear farther from the horizon, or at a greater altitude, than it would have done on this supposition.

If there were no atmosphere, B would be seen from A in the line AB at X; when light passes through the atmosphere it is seen at Y. The effect therefore of this bending or refraction of light, on the place of the body, is XY.

By the laws of refraction the ray BD is refracted at D in a plane passing through BD and a straight line perpendicular to the surface of the atmosphere at D, that is, in a plane passing through C, the centre of the earth.* In like manner DE must be refracted at E in a plane passing through DE and C; and so on. The ray, therefore, must enter the eye at A in a plane passing through C; and hence it is evident that the course of the ray BDEF must be in a vertical plane or circle of altitude AZH, passing through B and A. Consequently X and Y are in a vertical circle, and the body B is raised in altitude by the arc XY.

The thickness of each lamina of air from D to A has been supposed to be finite; but the same observations will be true however much this thickness is diminished: it will therefore be true, when the density of the air continually increases from D to A, that is, in the natural state of the atmosphere. In this case the line DEFGA will be a curve line, and the heavenly body will be seen by the spectator at A in the direction of a tangent to the curve at that point. (See *App.* 6.)

(125.) It is known from experiment that a ray of light does not alter its course when it enters, or rather is incident upon, any refracting medium perpendicularly. Hence, when a heavenly body is seen in the zenith at Z, so that a ray of light in coming from it in the line ZA cuts the atmospheric laminæ at right angles, in that case there is no refraction. It is also known, from experiment, that the greater the difference between the angles an incident ray makes with the surface of any medium, that is, the more acute the angle is on one side of the ray, and the more obtuse on the other, the greater will be the deviation. Now the greatest difference between these angles will take place for a visible body when it is seen in the horizon. From the zenith to the horizon, therefore, refraction will increase from nothing to its greatest value, which is about 34'.

(126.) The quantity of refraction varies with the state of the air: from experiment it is found, under other similar circumstances, to be proportional to the density of the air by which a ray is refracted. And the density is measured by its pressure and temperature. The degree of its pressure is shewn by the barometer; the degree of its temperature by the thermometer. After a table therefore has been constructed, shewing the refraction of a heavenly body at different altitudes from the horizon to the

* The earth is here considered as a sphere.

zenith for a supposed mean or average state of the air, it becomes necessary to construct other tables by which the necessary corrections (see Naut. Tab. (*z* 4)) may be made for any particular state of the air differing from this (See *App.* 6).

The mean state of air is assumed to be such that Fahrenheit's barometer stands at 30 inches, and the thermometer at 50 degrees.

(127.) The following astronomical phenomena are produced by the refraction and reflection of light.

Owing to the refraction of light, the sun is seen wholly at rising and setting when its lower limb is in reality 34' below the horizon. For a ray of light, coming from a point supposed so placed, is bent, in passing through the earth's atmosphere, into a curve line, which just touches the surface of the earth where the spectator stands. Such a ray therefore enters the eye as if it came in the plane of the visible horizon, and the point of the sun from which the ray proceeds is seen apparently in the same place. The body of the sun must then be seen just above the horizon.

In a similar manner is explained the twilight, which we experience a short time before the sun is visible in the morning and after it sets in the evening. A ray of light coming from the sun 18° below the horizon of the spectator, after passing once through the atmosphere, just touches the earth, and then goes on in a line still concave to the earth till it reaches again the upper regions of the atmosphere. It is there partly reflected, and again passes down through the atmosphere to a farther point on the earth's surface, where the spectator is supposed to be placed, and where it produces a slight degree of light. The number of rays that in this manner reach this point increases, as the sun rises nearer to the horizon, and thus the light gradually increases.

It is owing to the different effects of refraction on light coming from the upper and from the lower limb of the sun, that at rising and setting it assumes an oval form, its horizontal diameter appearing greater than the vertical one. The lower side or limb is raised by refraction more than the upper, because it is nearer to the horizon; and consequently the vertical diameter is contracted, while the horizontal diameter remains nearly the same.

At the same time also, it appears to be much larger than at any other time. For the solar rays which then come to the spectator, nearly in the plane of the horizon, lose much more light than when the sun is at a considerable altitude, because they pass through a much greater space of the lower and denser strata of the atmosphere.

In consequence of this greater diminution of light when the sun is near the horizon, it appears much less brilliant in that situation than when it is higher. This gives us an idea of its greater distance. But when, of bodies subtending in reality the same angle at the eye, one appears farther from us than another, we imagine that the former is superior in magnitude. Thus, if, of two ships filling the same space on the horizon, one seems to be at a much greater distance than the other, we imagine this to be the larger.

(128.) From the foregoing articles respecting parallax and refraction, it appears that on account of refraction the apparent place of a heavenly body as seen from the surface of the earth is higher, that is, nearer the zenith, than as seen from the centre of the earth. Hence, in reducing the apparent altitude to the true altitude, the effect of refraction, which may

be taken from a table, must be subtracted. Thus the altitude corrected for refraction is found. On account of parallax, the place of the body is lower as seen from the surface of the earth than from the centre; that is, the apparent altitude is less than the true. The necessary correction therefore for parallax is to be added. The table from which the correction is taken should strictly be entered with the apparent altitude corrected for refraction.

(129.) The correction for refraction is taken from the same table for all heavenly bodies; the correction for parallax is taken from a separate table for each, since it depends on the distance of the body, or on the horizontal parallax, which is a measure of the distance.

(130.) In nautical questions it is usual to combine the refraction with the parallax by taking their difference, which difference is called the *correction in altitude*. This correction in altitude is taken from one table for the sun, and is subtractive, because refraction is greater than parallax; and from another table for the moon, and is for this body additive, because the parallax in altitude of the moon is greater than refraction. Each table is entered with the apparent altitude as observed, which is sufficiently exact for nautical purposes. (See *Naut. Tables (m)* and *(w)*).

For fixed stars the only correction applied is for refraction; since they may be considered as having no parallax.

(131.) In the following examples the corrections for refraction and parallax are first applied separately, and then together in one. They are applied only to the nearest second. (See *Naut. Tables (m)* and *(w)*).

A. Alt. Sun's Cr.	12° 42' 17''	38° 45' 29''	82° 20' 16''
Refraction.	4 13	1 13	8
	<hr/>	<hr/>	<hr/>
	12 38 4	38 44 16	82 20 8
Parallax.....	8	7	1
	<hr/>	<hr/>	<hr/>
T. A.....	12 38 12	38 44 23	82 20 9

Or thus :

A. A. Sun's Cr.....	12° 42' 17''	38° 45' 29''	82° 20' 16''
Corr. in Alt.	4 5	1 6	7
	<hr/>	<hr/>	<hr/>
T. A.....	12 38 12	38 44 23	82 20 9
	<hr/>	<hr/>	<hr/>
For Moon, Hor. Par....	60' 17''	58' 42''	54' 18''
A. A. Moon's Cr.....	16° 37' 20''	42° 18' 20''	80° 18' 49''
Refraction.....	3 13	1 +	10
	<hr/>	<hr/>	<hr/>
	16 34 7	42 17 16	80 18 39
Par.....	57 47	43 26	9 9
	<hr/>	<hr/>	<hr/>
T. A.....	16 31 54	43 0 42	80 27 48

Or thus :

A. A. Moon's Cr.....	16° 37' 20''	42° 18' 20''	80° 18' 49''
Corr. in Alt.....	54 34	42 22	8 59
<hr/>			
T. A.....	17 31 54	43 0 42	80 27 48
For a star.			
A. A. Star.....	70° 15' 35''	45° 20' 32''	6° 30' 15''
Corr. in Alt.....	21	57	7 58
<hr/>			
T. A.....	70 15 14	45 19 35	6 22 17

(132.) When corrections are used for the height of the quicksilver in the thermometer and barometer, refraction and parallax may be applied separately; and for this purpose the parallax in altitude of the moon may be computed by the following rule. To the *prop. log.* of the horizontal parallax, add the *log. secant.* of the apparent altitude corrected for refraction, and reject 10 from the index. The result will be the *prop. log.* parallax required. This rule is easily deduced from the third formula at (3) in Art. 118, namely, $p'' = H'' \sin z$.

To find the Latitude of the Observer's Place on the Surface of the Earth.

(133.) By the latitude here is meant the *true* latitude or latitude on the spheroid, which is the zenith distance of the equator represented in fig. Art. 84 by ZE. An altitude instrument (see Art. 116) is supposed to be placed in the meridian, and the apparent altitude of a fixed star near the celestial pole is determined by it, both when it passes the meridian above the pole, as at M (fig. Art. 84), and below the pole, as at N; the star from its proximity to the pole being supposed visible to the observer at both meridian passages. These two apparent altitudes are supposed to be corrected for refraction from a table of refraction: the results will be the true altitudes. Then half the sum of these will be the latitude required. For, the star's polar distance remaining the same during the interval of the observations, it must pass as much above the pole at the upper transit as below at the lower transit. The sum of the altitudes must therefore be twice the altitude of the pole, and half the sum the altitude of the pole itself, which in Art. 104 was shewn to be equal to the latitude.

By repeated observations of this kind on the same and different circum-polar stars, the latitude of a fixed observatory is found with great nicety; subject however to any slight error in the table of refraction made use of, as well as in the instrument by which the altitudes have been supposed to be taken.

Ex. The apparent altitude of the α Urs. Min. (*Polaris*) above the north pole is $52^{\circ} 28' 17''.5$; its apparent altitude below the pole is $50^{\circ} 47' 16''.2$; thermometer 60; barometer 30.5: required the latitude.

A. A..... above Pole	$52^{\circ} 28' 17''.5$	Below Pole	$50^{\circ} 47' 16''.2$
Refr. corrd. for Ther. and Bar.	44 .1		46 .9
<hr/>			
	52 27 33 .4		50 46 29 .3
	50 46 29 .3		
<hr/>			
Half Sum....	51 57 1 .3	Lat. required.	

To find the Declination of a Heavenly Body.

(134.) By an instrument, the principle of which has been described in Art. 116, the apparent zenith distance of any heavenly body may be determined as it passes the meridian. Let this be corrected, from a table of refraction if it be a fixed star, and from a table of parallax also if any other heavenly body; we have then the true zenith distance of the body. But we know also the zenith distance of the celestial equator, which is the latitude of the place. Hence therefore we must know the distance of the body from the equator; which is its declinations.

Ex. In latitude $50^{\circ} 48' 2'' .5$ N. the true meridian altitudes of three fixed stars were respectively $43^{\circ} 27' 49'' .4$ (zen. N.); $29^{\circ} 42' 3'' .3$ (zen. N.); $88^{\circ} 49' 24'' .3$ (zen. S.): required their declination.

True Zen. Dist..	$46^{\circ} 32' 10'' .6$ N.	$60^{\circ} 17' 56'' .7$ N.	$1^{\circ} 10' 35'' .7$ S.
Lat. N.....	$50\ 48\ 2\ .5$ N.	$50\ 48\ 2\ .5$ N.	$50\ 48\ 2\ .5$ N.
Decl.	$4\ 15\ 51\ .9$ N.	$9\ 29\ 54\ .2$ S.	$51\ 58\ 38\ .2$ N.

(135.) Whether the sum or difference of the latitude and true zenith distance is to be taken, and whether the resulting declination is north or south, may be easily determined by sketching a figure to represent the particular case. Make a circle to represent the horizon as in fig. Art. 95; **having** the zenith Z at the centre, and the pole P at the estimated distance of the latitude from the north or south point according as latitude N. or S. Draw the equator EQ, and then, by marking a place on the meridian at the given distance from the zenith north or south, the method of proceeding will be seen in each case. (See *App.* 14.)

To find Obliquity or Inclination of the Equator to the Ecliptic.

(136.) The declination of the sun may be determined as above by observation, every day at noon, as it passes the meridian; by which means the inclination of the equator to the ecliptic may be found. Thus let ACL (see fig. Art. 95) be the half of the ecliptic to the north of the celestial equator, A the first point of Aries, L the first point of Libra, C a point half way between A and L, that is, the first point of Cancer, which is 90° from A and L. Let ABL be half the celestial equator corresponding to the half ecliptic ACL. Then, as the sun apparently describes ACL, its declination must every day increase from A to C. When the sun is at C, the declination is the greatest; from C to L the declination decreases again to nothing. The arc CB is the declination at C, or the greatest declination; which, since C is 90° from A, must measure the angle at A or L, that is, the inclination of the equator to the ecliptic. Let therefore the meridian altitude of the sun be supposed to be observed on the day it passes through C, that is, let the sun be supposed to be at C at the instant of a meridian observation. From this meridian altitude, properly corrected, and the latitude of the place, the declination may be deduced; which is the inclination required.

This inclination may be determined in a similar manner, from the meridian altitude of the sun observed when it is at the first point of Capricorn, which is the point of the ecliptic the farthest to the south.

(137.) From the meridian altitudes of the sun, observed at both points, the inclination of the equator to the ecliptic may be found without using the latitude of the place. For if i denote the inclination, z the meridian zenith distance at the first point of Cancer, z' that at the first point of Capricorn, d the greatest declination, north or south, of the sun, and l the latitude supposed north and greater than the declination; then at the first point of Cancer $d = l - z$, and at the first point of Capricorn $d = z' - l$; adding these two equations $2d = z' - z$ or $d = \frac{1}{2}(z' - z)$; that is, the inclination is equal to half the difference of the true zenith distances of the sun.

The same may be easily shewn to be true for any other latitude.

In the foregoing method of finding the inclination of the celestial equator to the ecliptic, the sun has been supposed to be at the first point of Cancer or Capricorn precisely when on the meridian of the place of observation, which can only be the case for one meridian of the earth. For others the declination observed near the solstice is reduced to the solstitial declination. And this is done for several declinations observed about that time; so that, by taking a mean of the results, the inclination in question is determined very accurately.

Ex. On June 21, 1825, the true meridian altitude of the sun at Greenwich was $61^{\circ} 59' 3''$: required the inclination of the equator to the ecliptic; supposing the sun to have been at the first point of Cancer at the observation.

Here the true zenith distance of the sun is $28^{\circ} 0' 57''$, the zenith being north of the sun; the latitude is $51^{\circ} 28' 40''$ N.: hence by making a figure it will be apparent that the sun's greatest declination is $23^{\circ} 27' 43''$, which is the inclination required.

To find the Right Ascension of the Sun.

(138.) The declination of the sun being deduced as in Art. 134 from the meridian altitude of the sun, and the inclination of the equator to the ecliptic being known as above, we have given the angle A (see fig. Art. 84), and the side BD, to compute AD, the sun's right ascension; the sun being supposed to be between the first point of Aries and that of Libra.

In order to determine by this method the sun's right ascension with the greatest accuracy, its meridian altitude should be taken as near an equinox as possible, since then a small error in the observation will least affect the result.

To find the Right Ascension of a Fixed Star.

(139.) A clock is supposed to be adjusted so as to go regularly, and also to go 24 hours in one diurnal revolution of a fixed star. This is done by taking successive transits of the same fixed star and altering the length of the pendulum till the adjustment is made. Or, what amounts to the same, and is more easy in practice, the daily gain or loss of a clock on 24 hours in this interval is noted, and an allowance is afterwards made for it.

Although the star undergoes a small apparent change of place, yet it is so small in the time of adjustment, that the clock may be considered as going exactly 24 hours in one complete revolution of the earth.

Let the time by such a clock be supposed to be taken when the sun passes the meridian, and also afterwards when the star, whose right ascen-

sion is required, passes the meridian. Then the difference of times, properly corrected, will be the difference of the sun and star's right ascensions. Hence, if the right ascension of the sun be found as in Art. 138, the right ascension of the star may be easily deduced. And thus the right ascensions of several bright fixed stars may be determined.

Again, by comparing the times when these bright fixed stars pass the meridian, with the times any other heavenly bodies pass, the right ascensions of the latter may be also found. And thus we may proceed till the right ascensions of all the fixed stars are known, and of the other heavenly bodies at their transits.

(140.) Observations made in the manner pointed out in the above articles, and their results, confirm the supposition that has been made of the sun's describing, or appearing to describe, on the celestial concave a great circle: since it is found thus that the sun passes through all the places which would be deduced from computation on such an hypothesis.

The methods by which the right ascensions and declinations of the principal fixed stars, or of any other heavenly body, may be determined for any epoch, have been mentioned. These methods at different epochs have given different results, from which, at a very early period, it was concluded that the points in the celestial concave, where the celestial equator cuts the ecliptic, are shifted from east to west, that is, in a direction opposite to that in which the sun appears to move among the fixed stars, and in which right ascension is measured. It has likewise been discovered, by similar observations for finding the right ascension and declination of the principal fixed stars, that this recession of the first points of Aries and Libra is not uniform; also that the inclination of the celestial equator to the ecliptic undergoes slight periodical changes; and moreover that the fixed stars themselves have an apparent small annual motion, by which their places as determined by observation are found to be affected.

Precession of Equinoxes, &c. (See App. 7.)

(141.) If the earth were an exact sphere of uniform density, the axis round which it revolves as it is carried round the sun, together with the equator to which that axis is perpendicular, would always preserve the same position; since the attraction of the particles, of which it consists, to the sun, would exactly balance on a line joining the centres of the two bodies. This balanced attraction therefore can neither produce rotatory motion in the earth, nor influence one in any way which the earth may have. On such a supposition the celestial equator and pole of the heavens would remain fixed. But in fact the earth is not an exact sphere. By its whirling motion the particles near the equator are forced out from the centre, while those near the pole sink down; so that the form becomes that of a spheroid, having the greatest diameter at the equator, and the shortest one at the poles. We may consider the earth as consisting of an internal sphere surrounded by and attached to an outward spheroidal shell, which increases in thickness from the poles to the equator. In which case, although the inscribed sphere will, of itself, balance in every position on the radius vector or line drawn to the sun, yet the circumscribed shell will not do so, except in particular positions with respect to that line.

(142.) When the sun has south declination, its attraction on the shell tends to incline the north pole of the earth towards it. This tendency produces the effect of shifting the axis round which the earth performs its diurnal revolutions, and thus the equator is made to undergo a corresponding alteration of position with respect to its intersection with the plane of the earth's orbit round the sun, that is, of the ecliptic; and also with respect to its inclination to the ecliptic. These intersections, and consequently the equinoctial points, are shifted annually about $50''$ from east to west, or in a direction the opposite to that of the earth's motion round the sun: the inclination alternately decreases and increases about $1\frac{1}{2}''$.

(143.) When the sun has north declination, then the south pole of the earth has a tendency to incline towards the sun, and consequently the north pole to recline the contrary way, that is, the same way it does when the sun has south declination. Similar effects therefore on the place of the equinoxes and the obliquity must follow, as the ones just mentioned above.

(144.) Similar effects are also produced by the attraction of the moon, the lunar orbit round the earth being inclined to the equator: so that the moon for about a fortnight is north of the equator and the next fortnight south thereof. The discovery of these effects and their cause is due to Bradley.

(145.) The average regression of the equinoxes thus produced by the attraction of both the sun and moon is $50''.35$; of which about $14\frac{1}{3}''$ is to be attributed to the former body, and about $35\frac{1}{2}''$ to the latter. What the real regression varies at any time from the average, in consequence of variations in the disturbing effects of these bodies, is called *nutation* or *lunisolar nutation*.

(146.) The planets, by drawing the earth out of the ecliptic, that is, by thus producing a variation in the position of the ecliptic, modify in a certain degree the effect of the disturbing forces of the sun and moon as above. The average annual regression of the equinoxes is thus diminished at present $0''.12$; so that the correct average regression, called the *precession of the equinoxes*, is $50''.35 - 0''.12$, or $50''.23$. (See App. 7.)

Aberration of the Fixed Stars. (See App. 8.)

(147.) Beside the effects of lunisolar precession and nutation, and of planetary attraction, there is another small deviation of the fixed stars from their places as determined for any particular epoch, which is called aberration. Bradley's discovery of this preceded his discovery of nutation in point of time, but the same series of observations which led to one led also to the other. The star γ Draconis, situated nearly on the solstitial colure, passed the meridian at the vernal equinox farther from the pole by about $20''$, and at the autumnal equinox nearer to the pole by $20''$, than at either tropic. This could not be owing to nutation in the earth's axis: for if so, a star similarly situated below the pole on the solstitial colure would have been affected equally a different way; that is, when the polar distance of γ Draconis was increased $20''$, the polar distance of the other would have been diminished $20''$. This, however, was not the case.

(148.) On making observations on several other stars, Bradley found that the greatest alteration of polar distance, which for γ Draconis took place about the equinoxes, took place for other stars at different times of the year. He observed also, on whatever day any star deviated the most from its mean place in polar distance, that at the end of half a year from that day it deviated as much in the contrary direction, and that at the end of a whole year it returned to the same place as at first. From which it appeared that the period of this motion for every star was annual, and that it was connected some way or other with the place of the earth in its orbit.

(149.) After endeavouring, for some time without success, to account for this change in the observed place of a fixed star by different suppositions, he was at length led to conceive that all the phenomena observed might be an effect of the earth's rapid motion round the sun combined with the motion of light; from the consideration that the apparent place of a fixed star cannot be the same when the eye is at rest as when it is moving in any other direction than that of a line passing through the eye and the star; and that, when the eye moves first in one direction and then in another, the apparent place of the star must alter. Considering light as a fluid flowing from a fixed star, an eye at rest would receive it in the direction of the stream, and the body would be seen in its true situation. Supposing light to be a quiescent fluid, and the eye to move through it, an impression would be made in a direction opposite to that of its motion, and the star would always be seen in the line in which the earth was moving. The fact is, both light and the eye are in motion; an impression is therefore made on the eye by a ray of light in an intermediate direction, and the star is seen between its true place and the line of the earth's motion; much nearer however to the former than the latter, because the velocity of light greatly exceeds that of the earth. (See *App.* 8.)

(150.) The aberration is in a great circle, the plane of which evidently passes through the true place of the star and the line of the earth's motion. And since the latter, that is, the line of the earth's motion, during a whole revolution of the earth round the sun, traces out the ecliptic, it appears that the great circle in which aberration takes place, supposing the star to be out of the ecliptic, revolves round the sphere of the fixed stars, and consequently the apparent place of the star describes a small orbit* round its true place, which is supposed invariable.

If the star be in the ecliptic, the above-mentioned revolving circle coincides with the ecliptic; aberration therefore is then wholly in longitude.

(151.) The amount of aberration evidently depends on the velocity of light, the velocity of the earth, and the direction in which the earth is carried through the stream of light flowing from the star. The two former may be considered as constant; but the last, namely, the angle at which the earth passes through the rays of light, is continually varying, not only for different stars, but also for the same. Aberration, therefore, with respect

* The apparent changes of place in the fixed star during an entire revolution of the earth round the sun would be the same if the spectator, instead of moving round that body, were supposed to move from one single point, with the earth's velocity, in every direction with respect to a line drawn to the sun; keeping always, however, in the plane of the earth's orbit.

both to direction and quantity, considering all the stars which are observed in the heavens, must be infinitely varied; it must also undergo continual changes at different times of the year for the same star.

(152.) When the earth's motion is in a direction opposite to that of the stream of light coming from the body, or in the same direction with it, that is, when the earth moves directly towards or from the body, there is no aberration. As this angle increases, aberration increases; and when it becomes a right angle, aberration is the greatest. Thus, since the earth may be considered as always moving perpendicular to a line drawn to the sun, it follows that the sun's aberration, which is wholly in longitude, is always the greatest. It would be the greatest also for a star situated in the pole of the ecliptic, from which, if rays were propagated, they might be considered as everywhere perpendicular to the earth's orbit.

(153.) Since aberration for the same star takes place at different times of the year in the direction of every great circle passing through the star's true place, it must take place twice in the year in a circle of declination, and twice in the year in a circle perpendicular to this, which may be considered as a parallel of declination. Twice in the year, therefore, aberration takes place wholly in declination, and twice wholly in right ascension.

A similar remark may be made concerning aberration in latitude or longitude.

(154.) Bradley determined from this theory a general expression for aberration in terms of its greatest value supposed unknown, and of terms that were known. This expression he compared with the result of observation, when its whole value could be measured by an instrument, that is, when it was wholly in declination or on the meridian. Hence he found its greatest value to be about $20''$. This therefore would be the aberration of a star in the pole of the ecliptic, and is actually the aberration of the sun, by which it always appears behind its true place.

To the above general observations on aberration it may be added, an effect of a similar kind arises also from the diurnal motion of the earth round its axis combined with the motion of light. This effect, however, is inconsiderable.

Aberration of the Planets and Moon.

(155.) The aberration of the planets and moon, strictly speaking, is the same as for the fixed stars. But there is a farther correction necessary in reducing their apparent places to their true. The earth passes through the stream of light flowing from a planet as from the fixed stars. But fixed stars may be supposed to retain the same situation during the transmission of light, while a planet really changes its situation during the time light passes from it to the earth, and that change is subject to observation and calculation. Hence, at the instant light from a planet enters the eye, there are two reasons why the observed place does not agree with the true. The first is aberration, a correction for which would give the situation of the planet at the instant light left it; but in the mean time the body has moved, and this motion forms a second correction. To compute therefore the true place of a planet from the apparent or observed, aberration must be first allowed as for a fixed star, and then the motion of the planet

as seen from the earth in the interval in which light is transmitted. And conversely, in calculating the apparent place of a planet, its true place must be first found for a point of time preceding the given one by the same interval, and then aberration allowed as for a fixed star.

If the planet be moving round the earth apparently in the same direction with the earth, the two corrections will partly cancel each other. If its velocity were the same as that of the earth, they would do so exactly; which is the case with the moon. If the planet's apparent motion be in the opposite direction to that of the earth, the whole correction will be the sum of the two parts.

Proper Motions of Fixed Stars (see App. 9).

(156.) It is necessary, in treating on the apparent deviations of the stars from their places as fixed for some epoch, to add that after the required corrections have been applied on the several accounts enumerated above, still the observed right ascensions and declinations do not agree exactly with the computed ones, which they ought to do provided every source of deviation had been accurately estimated, and the instruments used in observing were either perfect or a sufficient number used to correct one another. As these deviations cannot be reduced to any law for the stars in general, but seem to be as various as the stars themselves, they are called *proper motions*. How far they are real motions in the stars, or arise from some shifting of the whole solar system, or are owing to imperfect computations and instruments, time alone and unceasing attention to the subject can determine.

Division of Time into Years, Months, Days, &c.

(157.) The interval between the sun's leaving an equinox, and coming to the same equinox again, is called a solar year. The number of days, hours, minutes, &c. in this according to sidereal time, and thence according to mean solar time, is found by observing the meridian altitude of the sun on the day before it passes the celestial equator, and again the day after; from which observations the instant of its being at the equinox, as shewn by the clock, may be easily deduced. If several years have elapsed between two observations of this kind, and the whole interval be divided by the number of years, we shall thus get the length of a solar year very nearly.

Since the equinoctial points have an annual motion of about $50''$, by which they are carried back to meet the sun in its apparent revolution from west to east, it is evident that the sun will return to the same equinox, sooner than to the same fixed point in the heavens. A solar year therefore is less than the time in which the earth makes a complete revolution round the sun; and moreover, since there is a small variation in the annual motion of the equinoxes, and also an alteration in the position of the earth's orbit, which affects the time of its revolution round the sun, it follows that the length of a year, determined as above at different periods, would not be exactly the same. By comparing the most ancient observations of this kind on record with the most modern, applying the proper corrections, a mean solar year has been found to consist of $365^d 5^h 48^m 47^s$ in mean solar time. Delambre makes it $365^d 5^h 48^m 51^s.6$ by more than 1200 calculations.

(158.) The time of the sun's describing the arc of the ecliptic, through which the equinoxes according to their mean motion recede, being added to the length of a mean solar year, the result will be the interval in which the earth makes a complete revolution round the sun. This interval is called a sidereal year, and consists of $365^{\text{d}} 6^{\text{h}} 9^{\text{m}} 11^{\text{s}}$.

(159.) The mean solar year is the one made use of in the common division of time, because the same succession of seasons, and the same variation in the length of the days, recur with it periodically. Four of these years amount to $1460^{\text{d}} 23^{\text{h}} 15^{\text{m}} 8^{\text{s}}$, that is, nearly to an exact number of days. In our calendar a common year is made to consist of 365 days, and every fourth year of 366 days. According to this account therefore $44^{\text{m}} 52^{\text{s}}$ is reckoned every four years more than four times the period of the seasons, an error which in 128 years amounts very nearly to a whole day. To correct this, in every centenary year, as 1700, 1800, &c., when the number of centuries is not divisible by 4, the additional day is omitted; by which means the calendar is rendered sufficiently exact for all the common purposes of history and chronology.

(160.) Before the period of the sun's apparent revolution in the ecliptic was determined with much precision, the year was divided in such a manner, as to produce great confusion in the arrangement of the seasons, and of the festivals, which generally bore some allusion to the seasons. By the Jewish, Greek, and Roman nations, the lunisolar year, which consists of twelve complete lunations or of 354 days, was used; different corrections being applied to it for the purpose of preserving the same order in the months and seasons, as by the addition of a month every third year, three months every eight, &c. Among the Egyptians the solar year of 365 days was used, and this was at length adopted also by the Romans, through the influence of Julius Cæsar, at the time he possessed the whole power of the government. He began the first year of a new calendar in the 707th year from the foundation of Rome, six days after the winter solstice, that happening to be the time of a new moon. In the 1st, 5th, 9th, &c. year, that is, in every fourth year, he directed an additional day to be included, by reckoning a particular day in February twice, namely, the sixth day before the calends of March; from which circumstance these years are called bissextiles. According to this calendar, the 45th Julian year, in which our Saviour was born, was a bissextile; and hence it happened that the 4th, 8th, and every year of our calendar divisible by 4 without a remainder, is a bissextile or leap year; excepting centenary years, in which the number of centuries is not divisible by 4.

(161.) From the construction of the Julian calendar it is evident that an additional error of $44^{\text{m}} 52^{\text{s}}$ would be found in every fourth year, which at length would be sensibly felt in the recurrence of the festivals as connected with the seasons. And this was in reality the case; for the festivals of the Christian Church being arranged by the Council of Nice according to this calendar, Easter Sunday was in process of time found to happen many weeks from the Jewish Passover, which was regulated by the new moon, of which the full moon was the next after the equinox, and near which it was the intention of the Council of Nice to fix it. In 1582, in the reign of Gregory XIII., the head of the Roman Catholic Church, the vernal equinox, instead of taking place on the 21st of March, as at the assembling

of the Council of Nice, fell on the 11th of that month ; and to bring back the same days of the month to the same places of the sun with respect to the equinoctial points, it became necessary to substitute in the calendar the 21st for the 11th. Gregory XIII. not only made this correction, but, to prevent the recurrence of a similar error in future, he ordered that every centenary year should be considered only as a common year of 365 days, although according to the Julian calendar it should be a bissextile. Since however the error amounts to a whole day in 128 years, this deviation from the Julian calendar is at present limited to those centenary years in which the number of centuries is not divisible by 4. The error now will be only 0.944 days in 4000 years.

(162.) The year was divided in the calendar of Julius Cæsar into 12 months, seven of thirty-one days, four of thirty, and one of twenty-eight or twenty-nine, according as it was a common or bissextile year. The same division is at present in use, and is applied to the civil purposes of life : but the space of 28 days is also called a month, one-fourth of which is called a week. A natural day consists of 24 mean solar hours, and is either civil or astronomical. The civil day begins and ends at midnight, the astronomical day begins and ends at noon.

Any hour in the first 12 hours of the civil day from midnight to the following noon is said to be such an hour A. M. (*ante meridiem*) ; in the latter 12 hours, that is, between noon and the following midnight, it is said to be P. M. (*post meridiem*). In the astronomical day the hours are reckoned from 0 at noon up to 24, without any distinction of this kind.

The astronomical day begins 12 hours after the civil day of the same name. Thus April 4, 1825 (civil), begins at midnight between Sunday and Monday ; April 4 (astronomical) begins at Monday noon.

(163.) Those points of time from which historians and chronologists reckon are called epochs or æras. That from which we reckon, and to which we are accustomed to refer all others, is the commencement of the year immediately following the birth of Christ, which event has been fixed on the 25th of December, in the 45th year of the Julian calendar. The creation of the world is an epoch from which the sacred writers have traced the events recorded in the Scriptures, and it is by observing the course of these events that chronologists have fixed this epoch between 3950 and 4000 years before Christ. The epoch used by the Grecian States was that of the institution of the Olympic Games, which were celebrated every fourth year at Olympia by a general assembly from those states. It is placed 776 years before Christ. The Roman epoch was the building of Rome, 752 years before Christ. The Turkish epoch is the flight of Mahomet, which took place 622 years after Christ.

General Motions and Phases of Moon, Planets, &c.

(164.) The moon describes an orbit round the earth, at the distance of about 240 thousand miles, in a month. We may be supposed to commence our observations on it when it first appears, after having been for several days invisible in the neighbourhood of the sun. The moon is then seen in the west immediately after sunset, at a little elevation above the horizon, or a little to the east of the sun. The illumined or bright part has the form of a thin crescent, or of the letter C, the back of which is turned towards that point where the sun has just set. The next night the

moon is again seen in the same quarter, at the same hour, but at a greater altitude than the preceding evening, or farther to the east of the sun. A perceptible though slight change has likewise taken place in its appearance; the crescent is become something broader, most so towards the middle, and gradually less and less towards its extremities, or, as they are called, towards its cusps, which remain as before sharp and brilliant points. On each succeeding evening a similar change takes place in the relative situation and in the appearance of the moon. It is removed farther towards the east from the point where the sun sets; and the crescent, at first so thin as to be scarcely perceptible, is continually enlarged, and in a few days is distinctly seen in the day.

(165.) When the moon is 90° to the east of the sun, and is on the meridian nearly at sunset, the whole space between the cusps becomes enlightened, and the moon has the appearance of a luminous semicircle. When the distance of its centre from that of the sun, measured on the ecliptic, is exactly 90° , that is, when the difference of the sun's longitude and moon's longitude, as seen from the earth, is 90° , the moon is said to be in quadrature; which relative position of the moon and the sun is denoted by the astronomical symbol \square . This is the end of the first quarter, or the beginning of the second.

The moon, that is, the enlightened part as seen at the earth, goes on increasing in distance from the sun and at the same time in apparent magnitude. The light gradually extends beyond the line of cusps, till the visible disk becomes a complete circle. This is the end of the second quarter, or full moon. The sun and moon are seen at this period in opposite points of the heavens; when one rises the other sets, and their distance is about 180° . The moon is said to be in opposition at that particular point of time when the arc of the ecliptic intercepted between circles of latitude passing through the centres of the two bodies, or when the difference of their longitudes, is exactly 180° ; which relative position of the moon and the sun, as seen from the earth, is denoted by the symbol \oslash .

(166.) A few days after full moon, we find that it does not rise till some time after sunset; and that at sunrise it is at a considerable altitude above the western part of the horizon, returning apparently towards the sun in the east. During this approach the western side of the moon gradually loses its light. At the distance of 90° in longitude from the sun, or when the moon bears about south at sunrise and is again in quadrature (\square), the visible disk is again reduced to a luminous semicircle. This is the end of the third quarter.

In the fourth quarter the visible part of the moon again takes the form of a crescent, which regularly decreases with its distance from the sun. At length it is just seen at daybreak, near the point where the sun is about to rise; and then, from its small quantity of light and proximity to the sun, it becomes invisible. It afterwards passes, without being seen, across the sun from west to east, till it is again perceived like a crescent at sunset, as at first. When the moon is in the same point of the heavens with the sun, or at change, it is said to be in conjunction; or, more properly speaking, when its longitude, as seen from the earth, is exactly the same as that of the sun; a coincidence which is expressed by the character \circ .

(167.) When the moon is at full, we frequently observe it to be either partly or wholly deprived, for a short space of time, of its light. The portion shaded is not always the same, but varies in different instances: sometimes the obscuration extends no farther than a very small segment at the bottom or at the top of the disk; sometimes it embraces the whole surface. This is called a lunar eclipse; a phenomenon which we have no great difficulty in accounting for, when we consider that at this time the earth is placed between the sun and the moon, and may therefore be easily supposed to intercept the solar rays in their transit to the latter body. The variety which we observe in the extent and situation of the part thus obscured, may arise from the moon's coming into opposition not always in the very same relative position, but sometimes raised above and sometimes depressed below the earth, so as to be partially seen from the sun. The moon most frequently passes through opposition without being shaded at all, the full moon being in such cases so far raised above or depressed below the earth, as to be wholly seen from the sun, although in the same part of the heavens with the earth.

(168.) The obscuration of that part of the moon which is eclipsed is neither complete, nor does it take place instantaneously. It is faintly illuminated by the rays of solar light, which, in their transit close to the earth, pass obliquely through its atmosphere; and are refracted or bent behind the earth, so as to fall on the darkened part of the moon. The eclipse does not take place instantaneously; because, as is manifest, part of the solar rays must be excluded from any given point on the moon's disk by the interposition of the earth, before the whole are. A spectator at the moon, who experiences an eclipse, loses sight of the sun gradually. Hence to a spectator at the earth a slight shade, called the earth's penumbra, is seen on the eclipsed part of the moon's disk before the darkest shadow, which is called the earth's umbra; and from this arises the difficulty of observing the beginning of a lunar eclipse, with sufficient correctness for finding the longitude of any place on the surface of the earth.

(169.) When the moon changes, or is in conjunction with the sun, it frequently intercepts the solar light, and causes an apparent obscuration of the sun. This is called a solar eclipse.

Sometimes at the greatest obscuration a segment only of the sun is darkened, sometimes the whole; and in some cases the central parts of the sun are eclipsed, and a small annulus near the circumference left bright, which is called an annular eclipse. These different appearances depend on the relative situations of the sun and moon, in point of latitude, at their conjunction. Most frequently the moon passes through conjunction without eclipsing the sun at all, owing to its being either too much elevated above or depressed below the sun at that time. It is in fact the earth that is really obscured at such times; and to a spectator at the moon, an umbra and penumbra would seem to pass over the earth, exactly in a similar manner to what from the earth we observe in a lunar eclipse.

This phenomenon is evidently owing to the intervention of the moon between the sun and the earth.

(170.) All the phases of the moon, as they have been briefly described, are easily accounted for on the supposition of its describing an orbit round the earth from west to east, and passing at change between the sun and earth.

At full the moon has the same face turned towards the earth, which is turned towards the sun. It appears therefore to a spectator at the earth to be completely illumined. A spectator at the moon at full would have the sun and earth nearly in the same line. On leaving that point in his revolution round the earth, he would have the sun and earth in different directions; different hemispheres of the moon would therefore be turned towards these bodies. In other words the hemisphere seen at the earth would be partly enlightened and partly dark. The withdrawing of light from the western edge of the moon is thus accounted for. As the moon proceeded in its course, less and less of her enlightened hemisphere would be turned towards the earth, and consequently less and less would be seen there. When the moon passed between the sun and earth, none of the enlightened hemisphere would be seen. From change to full, the moon would turn her enlightened face by degrees to the earth, till at length the whole would be again visible.

(171.) When the new moon first appears after change, we are able to see, not only the thin illumined crescent, which is turned towards the sun as well as the earth; but also the other part of the hemisphere, turned towards the earth alone, and therefore receiving no light directly from the sun. This shaded surface in fact receives, at this time, a faint light from the earth, which shines to a spectator at the moon with nearly a full orb, and it thus becomes visible.

(172.) By the moon's motion in its orbit, it would continually turn different hemispheres to us, if it did not revolve round one of its diameters as an axis, with an angular velocity nearly equal to that with which it is carried round the earth, and in the same direction, or from west to east. It is thus that the hemisphere, which is turned from the earth by the former motion, is brought back towards the earth again by the latter; by which means we always see the same face. Not exactly the same: for while the rotatory motion of the moon is uniform, that in its orbit is variable; through which there is a slight alteration in the face observed, towards the eastern and western edges. This irregularity is called a libration in longitude.

Also, the axis round which the moon revolves, not being perpendicular to the plane of its orbit, sometimes the north pole is inclined towards the earth, and sometimes the south. We thus see the surface of the moon over its poles alternately, in the same manner as a spectator at the sun, in summer, is able to see over the north pole of the earth, and in winter over the south. This is called a libration in latitude.

Planet Venus.

(173.) The planet Venus is sometimes seen in the western part of the heavens immediately after sunset, near the point where the sun has just sunk below the horizon. In a few days it appears to have moved from the sun to the eastward. The difference of the times of their setting increases, till the planet is thus separated from the sun about 46° ; when it sets 2 or 3 hours after the sun.

The planet now appears gradually to return westward, till it again sets nearly with the sun. Soon after, from its proximity to the sun, it becomes invisible.

During the interval of its thus leaving and again approaching the sun, Venus is called the *Evening Star*, because it is seen only during the evening.

When the planet is again seen, it appears a little to the west of the sun, just preceding the sun at rising. It afterwards moves westward, till it has gained a distance of about 46° from the sun, and rises 2 or 3 hours before sunrise. It then returns eastward, till it is again lost sight of in the solar rays.

During this interval Venus is called the *Morning Star*.

(174.) The apparent proper motion of the planet Venus is, therefore a kind of oscillation on each side of the sun, through an arc of about 45° . In passing from east to west, it is sometimes seen to traverse the sun's disk as a black spot. From this we conclude that it then passes between the sun and earth. When its longitude in this transit is exactly the same as that of the sun's centre, it is said to be in *inferior conjunction* (inf. \mathcal{P}).

In moving from west to east, it is never seen on the sun's disk; from which we conclude that it then passes at a greater distance from the earth than the sun. When its longitude in this transit is exactly the same as that of the sun, it is said to be in *superior conjunction* (sup. \mathcal{P}).

(175.) The phases of Venus, when seen through a telescope of sufficient magnifying power, are agreeable to the supposition of its describing an orbit round the sun, interior to that of the earth. From inferior to superior conjunction, it increases from a thin brilliant crescent, the back of which is turned towards the sun, to a fully illumined orb; and afterwards passing the sun from west to east, it gradually, in the same manner as the moon from full to change, alters its figure again to a crescent. Its apparent diameter, however, when it appears as a crescent, is much greater than when it appears as a full orb; from which circumstances it is inferred that the planet is nearer the earth in the former case than in the latter.

Mercury.

(176.) The apparent proper motion and phases of Mercury are similar to those of Venus. But the arc, through which it is separated from the sun, at its greatest elongation to the east and west, is never more than 29° ; and hence it rarely emerges sufficiently from the splendour of the sun's rays to be visible to the naked eye. Its oscillations to the east and west of the sun, that is, its revolutions round the sun, are also performed in shorter intervals of time than those of the planet Venus.

All the phenomena observed of this planet tend to prove that it describes an orbit round the sun inferior to that of Venus.

Mars.

(177.) The planet Mars is sometimes observed in *opposition* to the sun, and sometimes in *conjunction* with it; although in the latter case it never passes over the sun's disk, as Venus and Mercury do at inferior conjunction. In opposition, when it rises at sunset, and sets at sunrise, it shines with a full orb, and has a much greater degree of apparent magnitude and splendour than at any other period. We suppose it therefore to approach in opposition nearest to the earth. Afterwards, it moves with great rapidity towards the sun in the west, for about 36 days; and then with a

moderated velocity, till it is in conjunction with the sun. During this interval it first changes the form of its disk from an orb completely illumined, to one about three-quarters illumined; and then to a full orb again, much less however than when the planet is in opposition. Emerging from the sun's rays to the west, and rising a little before sunrise, it continues its course westward, with respect to the sun, till it comes again into opposition; the velocity of its motion from the sun and its phases undergoing the same alterations, taken in an inverse order, as in its transit from opposition to conjunction.

Referring the place of the planet Mars to the fixed stars, it appears from opposition to move from east to west, or is retrograde, about 8 degrees. It is then stationary a short time; after which it advances again to the eastward about 307 days, till it comes into conjunction with the sun. From this point it continues to advance eastward among the fixed stars, or is progressive for about 307 days more, at the end of which it is stationary, and then retreats about 8 degrees, till it is again seen in opposition. Upon the whole, from opposition to opposition, it appears to have made a whole revolution (360°) among the fixed stars, and about 48° more.

These apparent motions and phases are agreeable to the supposition that Mars describes an orbit round the sun, exterior to that of the earth, in about two years.

(178.) The apparent motions of the remaining planets, namely, Juno, Vesta, Ceres, Pallas, Jupiter, Saturn, and the Georgian, are similar to those of Mars; we conclude therefore their orbits to be exterior to that of the earth. Their progressive motion from opposition to opposition is less and less in the order in which they are placed, and the interval of the revolution of each increases therefore in that order also.

(179.) The planet Jupiter is accompanied in its revolutions round the sun by four Satellites, which may be distinctly seen through a telescope of moderate power. They move from west to east round the planet with great rapidity, oscillating apparently from one side to the other, exactly in the same manner as Venus does round the sun. In passing from west to east, they are deprived of the solar light, by the interposition of the planet between them and the sun; and, unless telescopes of great power be made use of, they disappear also in passing from east to west, by traversing over the bright disk of the planet. They are, moreover, sometimes hid from the view of the spectator on the surface of the earth, by the body of the planet; in which case they are said to suffer an occultation.

(180.) Saturn has seven Satellites, whose apparent motions and general phenomena are similar to those of Jupiter. This planet is besides remarkable for a flat ring of solid matter, by which it is encompassed; which accompanies the planet round the sun, as if it were attached to its body, and at the same time has a whirling motion in its own plane. At some points of the planet's orbit this ring is not seen; at others it appears as a narrow elliptic zone of light, which afterwards opens more and more, till the breadth is very nearly half the length; when it again contracts its dimensions gradually, till it becomes invisible.

To a spectator at the sun, such an alternate enlargement and contraction of the breadth of the ring might be very easily accounted for. From what was observed in Art. 84 respecting the different seasons of the

earth, it appears that at the equinoxes the plane of the earth's equator passes through the sun; at the solstices the sun is considerably above or below that plane. If the terrestrial equator were distinctly marked out on the earth, or rather a circular flat ring lying in its plane surrounded the earth at a short distance from the surface, we can easily conceive, that at the equinoxes a spectator at the sun would only view the edge of this equatorial ring, which might be too thin to reflect sufficient light for vision. But at the solstices, the light of the sun shining most directly on the flat side, the ring would appear as an oval of considerable breadth, and be seen most distinctly. From the equinox to the solstice, the sun being more and more elevated above or depressed below the ring; or what amounts to the same, by the annual motion of the earth and ring together, its plane being more and more depressed below or elevated above the sun, the light and breadth of the ring would continually increase. From the solstice to the following equinox, for a similar reason, the oval would become narrower and narrower, and its light at the same time would continually decrease.

The same phenomena would take place to a spectator at the sun viewing the ring of Saturn, during a whole revolution. At the points where the plane of the ring cuts the orbit of Saturn, the ring would be invisible; at the distance of 90° from these points, it would be most open and most enlightened. To a spectator at the earth these phenomena are in some measure modified. The ring is not visible there, unless the earth be on the same side of its plane with the sun. When the plane of the ring passes through the earth, or through the sun, or through any intermediate point, it cannot be seen. But in other respects, the same changes in its appearance and apparent dimensions take place at the earth as at the sun.

Uranus, or the Georgian, was discovered in 1781 by Dr. Herschel, who soon after observed six Satellites, which move round it and accompany it round the sun. The Satellites of the Earth, Jupiter, and Saturn move round their primaries from west to east, in orbits very little inclined to the ecliptic; the orbits of the Satellites of the Georgian are nearly perpendicular to the ecliptic.

TABLE OF ELEMENTS OF PLANETS' ORBITS.

	MERCURY.	VENUS.	EARTH.	MARS.	VESTA.	JUNO.	CERES.	PALLAS.	JUPITER.	SATURN.	URANUS, or GEORGIAN.
Mean Distance from Sun . . .	0.3870981	0.7233316	1.0000000	1.5236923	2.3676700	2.6690090	2.7672450	2.7728860	5.2027760	9.5387861	19.1823900
Mean Sidereal Revolution . . .	87.9692580 Days.	224.7007869	365.2563612	686.9796458	1825.7431000	1592.6608000	1681.3931000	1686.5988000	4332.5848212	10759.2198174	30586.8208296
Longitude Peri- helion . . .	1801. 74 21 46.9	1801. 138 43 53.1	1801. 99 30 5.0	1801. 332 23 56.6	1820. 249 33 24.4	1820. 53 33 46.0	1820. 147 7 31.5	1820. 121 7 4.3	1801. 11 8 34.6	1801. 0 6 29.8	1801. 167 31 16.1
Annual Increase.	+55.9	+47.4	+61.8	+65.9	+94.2	. . .	+121.3	. . .	+57.1	+59.5	+52.5
Inclination of Or- bit to Elliptic . . .	7 0 9.1	3 23 28.5	. . .	1 51 6.2	7 8 9.0	13 4 9.7	10 37 26.2	34 34 55	1 18 51.3	2 29 35.7	0 46 28.4
Annual Variation.	+0.18	-0.04	. . .	-0.01	-0.12	. . .	-0.44	. . .	-0.23	-0.15	+0.03
Longitude of Node	45 57 30.9	74 54 12.9	. . .	48 0 3.5	103 13 18.2	171 7 40.4	80 41 24.0	172 39 26.8	98 26 18.9	111 56 37.4	72 59 35.3
Annual Increase .	+42.3	+32.5	. . .	+26.8	+15.6	. . .	+1.5	. . .	+34.3	30.7	+14.2
Excentricity . . .	0.205514940	0.006860740	0.016783568	0.093307000	0.089130000	0.257848000	0.078439000	0.241648000	0.048162100	0.056150500	0.046679380
Secular Variation .	+0.000003866	-0.000062711	-0.00041630	+0.000090176	+0.00004009	. . .	-0.000005830	. . .	+0.000159350	-0.000312402	. . .
True Diameter .	0.389	0.975	1.000	0.517	Sun. 111.454	Moon. 0.275	. . .	. . .	10.820	9.982	4.332
Mass	$\frac{1}{2023810}$	$\frac{1}{405871}$	$\frac{1}{354936}$	$\frac{1}{2546320}$	1.000	$\frac{1}{2650200}$	. . .	. . .	$\frac{1}{1070.5}$	$\frac{1}{3512}$	$\frac{1}{17918}$
Gravity	1.03	0.98	1.00	0.33	27.90	0.16	. . .	. . .	2.72	1.01	. . .
Sidereal Rotation in Sidereal Time	h. m. s. 24 5 28	h. m. s. 23 21 7	h. m. s. 24 0 0	h. m. s. 24 39 21	d. h. m. 25 12 0	d. h. m. 27 7 43	. . .	. . .	9 55 50	10 29 17	. . .
Light and Heat .	6.680	1.911	1.000	0.431	. . .	. . .	. . .	. . .	0.037	0.011	0.003

Tables of Right Ascension and Declination, &c.

(181.) In computing the places of the heavenly bodies for any proposed time, it is usual first to consider their motions as uniform, that is, the *mean* or average value of their motion is allowed, and thus their *mean* places are found. The corrections, which it is necessary afterwards to apply in order from their mean places to get their true or apparent places, are called *equations*. Thus a catalogue of the fixed stars being formed, and their mean right ascensions and declinations settled for the beginning of some year, we hence compute the apparent right ascension and declination of any particular star, which may be wanted for the purpose of calculation or observation, as follows. First, the amount of precession is allowed for the years subsequent to the year of the catalogue. This precession is the effect on right ascension or declination of the *mean precession* of the equinox, arising from the attraction of the sun, moon, and planets, and also of proper motion, if any. When the mean right ascension and declination are thus brought up to the beginning of the given year, they are corrected for aberration and nutation, which last includes both the solar and lunar nutations, and also at the same time for the further precession from the beginning of the given year, up to the given day; and lastly, for proper motion, if any, for the fraction of year.

The result is the right ascension and declination of the star for the proposed time, as it is seen through an instrument, that is, its apparent right ascension and declination (see App. 10, 11).

(182.) In the Nautical Almanac the apparent right ascensions and declinations of the principal stars are thus computed and put down for every 10th day in the year, at the instants of their respective transits over the meridian of Greenwich: so that these elements may be taken out at once by inspection. In Tables edited by Mr. Baily under the sanction of the Astronomical Society of London, the mean right ascensions and declinations of nearly 3000 stars are given for the beginning of 1830, together with the amount of precession.

(183.) From Tables of the mean places of the sun, moon, and planets, their true right ascensions and declinations are annually computed, and put down in the Nautical Almanac; for the sun and planets they are put down for every mean noon at Greenwich; for the moon for every hour in mean time at Greenwich. Other elements also are inserted in the Nautical Almanac, as the *equation of time*, the *sun's semidiameter*, the *moon's semidiameter*, *horizontal parallax*, &c.; some for Greenwich mean noon each day, others for both Greenwich mean noon and midnight, &c. (see Nautical Almanac).

(184.) Whenever any one of these elements is required for the purpose of nautical computations, the first step is to ascertain at the instant proposed (at least nearly) Greenwich mean time, for which kind of time the Nautical Almanac is arranged. This is done commonly by estimating ship mean time from a pocket-watch, or otherwise expressing it according to the astronomical day (Art. 162); and then by *adding* the longitude in time if *west*, and *subtracting* the longitude in time if *east*, the result is a Greenwich date in mean time. The next step is to take from the Nautical Almanac the element required as put down for the mean noon, mean midnight, or mean hour, immediately preceding the Greenwich date, and

having computed the mean variation of the element from that period up to the Greenwich date, to add or subtract this variation or proportional part according to circumstances. The following rules and examples will explain more particularly the proper mode of proceeding.

*To get a Greenwich Date from Ship Date and Longitude.**

(185.) RULE. If the ship date in mean time be A. M., put the day one back and add 12 to the hours: if the ship date be P. M., write down the same date, merely omitting the letters P. M. When the *longitude is west*, turn it into time,† and add the result to the ship date expressed astronomically: the sum, if less than 24, will be the corresponding Greenwich date in the same day with the ship date; if greater than 24^h, reject 24^h, and put the day one forward. When the *longitude is east*, turn it into time, and if less than the hours and minutes of the astronomical ship date, subtract the result; the remainder will be the corresponding Greenwich date in the same day with the ship date: if the east longitude in time be greater than the hours and minutes of the astronomical ship date, add 24 hours to the latter and put the day one back, before the subtraction takes place.

It will be sufficient in general to use the Greenwich date to the nearest minute only.

Ex. 1. Required the Greenwich dates to the nearest minutes corresponding to the instants of the following ship dates in mean time and the given longitudes.

1. Ship, Dec. 20, 6^h 14^m P. M.; longitude 42° 17' W.
2. Ship, June 3, 7 15 A. M.; longitude 140 14 E.
3. Ship, March 12, 11 20 A. M.; longitude 37 28 W.
4. Ship, April 10, 4 16 P. M.; longitude 68 32 E.

(1.) Sh. Dec. 20	6 ^h 14 ^m	(2.) Sh. June 2	19 ^h 15 ^m
Long. in T.	2 49 W.	Long. in T.	9 21 E.
Gr. Dec. 20	9 3	Gr. June 2	9 54
(3.) Sh. March 11	23 ^h 20 ^m	(4.) Sh. April 9	28 ^h 16 ^m adding 24 ^h
Long. in T.	2 30 W.	Long. in T.	4 34 E.
Gr March 12	1 50 (rej. 24 ^h)	Gr. April 9	23 42

To take out the Sun's Declination for any Ship Date in Mean Time.

(186.) Get a Gr. date as in Art. 185, or as in note thereto. Take out of the Nautical Almanac the sun's declination for the mean noon preceding the Greenwich date and for the mean noon following it, prefixing the proper names N. or S. When the names are like, take the difference, to

* A Greenwich date is in general got most easily by applying to the time shewn by a chronometer its known error on Gr. M. T.

† This may be done easily by means of table of log. haversines (see Naut. Tables).

which prefix the same name with the declinations themselves when the latter is the greater, and a contrary name when the latter is the less. When the declinations have *different names*, add them, and to the sum (which is in fact the change or difference of declination) prefix the name of the latter.

To the *proportional logarithm* of this difference in declination, add the *Gr. date logarithm* for sun of the hours and minutes of the Greenwich date. (See *Naut. Tables*, p. 14.) The sum will be the *proportional logarithm* of the required part; which part mark with the name of the whole difference in declination. The sum or the difference of this and the declination first put down will be the declination required; the *sum*, with the name of either, when the names are *alike*; and the *difference*, with the name of the greater, when the names are *unlike*.

Ex. Required the sun's declination for the following Ship dates in mean time.

(1.) Sh. April 10, at 6^h 10^m P. M., in longitude 50° 30' W.

(2.) Sh. Feb. 16, at 0^h 40^m A. M., in longitude 104° 30' E.

(3.) Sh. March 21, at 1^h 10^m P. M., in longitude 136° 15' E.

(1)	(2)	(3)
Sh. April 10, 6 ^h 10 ^m	Sh. Feb. 15, 12 ^h 40 ^m	Sh. March 20, 25 ^h 10 ^m
Long. in T. 3 22 W.	Long. in T. 6 58 E.	Long. in T. 9 5 E.
Gr. April 10, 9 32	Gr. Feb. 15, 5 42	Gr. March 20, 16 5
Decl. April 10, 7 ^o 52' 26.8 N.	Feb. 15, 12 ^o 43' 55.2 S.	Mar. 20, 0 ^o 13' 53.7 S.
11, 8 14 35.1 N.	16, 12 23 14.4 S.	21, 0 9 47.7 N.
22 8.3 N.	20 40.8 N.	23 41.4 N.
.91023	.93965	.88068
.40097	.62434	.17384
1.31120	1.56399	1.05452
0° 8' 47".5 N.	0° 4' 55" N.	0° 15' 52".5 N.
7 52 26.8 N.	12 43 55.2 S.	0 13 53.7 S.
Decl. 8 1 14.3 N.	12 39 0.2 S.	0 1 58.8 N.

To take out the Sun's Right Ascension.

(187.) The rule in Art. 186 may be followed for taking out also the sun's right ascension, prefixing the name or sign + to each right ascension taken out for the preceding and following mean noons, the contrary sign being considered —.

When the latter right ascension put down from the Nautical Almanac is less than the former (having gone through 24^h), the 24^h must be restored or added to the latter; and if the right ascension finally computed be greater than 24^h, the 24^h must be rejected.

Ex. Required the sun's right ascension for the following Ship dates in mean time.

(1.) Ship, June 12, at 11^h 50^m A. M., in longitude 162° 30' W.

(2.) Ship, March 21, at 2 20 P. M., in longitude 37 31 E.

(1)				(2)			
Sh. June 11,	23 ^h 50 ^m			Sh. March 20,	26 ^h 20 ^m		
Long. in T.	10 50 W.			Long. in T.	2 30 E.		
<hr/>				<hr/>			
Gr. June 11,	34 40			Gr. March 20,	23 50		
Gr. June 12,	10 40						
<hr/>				<hr/>			
Sun's R.A. June 12,	5 ^h 12 ^m 23.18+			March 20,	23 ^h 57 ^m 51.85+		
	13, 5 16 31.67+			21, 24 1 30.17+	add. 24 ^b		
<hr/>				<hr/>			
	4 8.49+				3 38.32+		
	1.63809				1.69397		
	.35218				.00303		
<hr/>				<hr/>			
	1.99027				1.69700		
	1 ^m 50 ^s .5+				3 ^m 37 ^s +		
	5 12 23.18+				23 57 51.85+		
<hr/>				<hr/>			
R. A. 5 14 13.68				0 1 28.85	rejecting 24		

To take out the Sun's Longitude and Latitude.

(188.) The sun's longitude and latitude are taken out in the same manner as its right ascension and declination. (See Rule, Arts. 186 and 187.)

To take out Planet's Right Ascension and Declination.

(189.) A planet's right ascension and declination are inserted in the Nautical Almanac for every Greenwich mean noon, and are taken out for the reduced Greenwich date in the same manner as for the sun (see Arts. 186, 187), using the Greenwich date logarithm for the sun, (*Naut. Tables*, p. 14).

Ex. Required the right ascension and declination of the planet Jupiter, for Ship Dec. 5, 1834, at 7^h 40^m mean time, in longitude 45° 27' W.

		R. A.	Decl.
Sh. Dec. 5,	7 ^h 40 ^m	Dec. 5, 1 ^h 38 ^m 22 ^s .24+	8° 55' 33".9 N.
Long. in T.	3 2 W.	6, 1 38 35.10+	8 57 2 .0 N.
<hr/>		<hr/>	
Gr. Dec. 5,	10 42	12 .86+	1 28 .1 N.
	2.92283		2.08894
	.35083		.35083
<hr/>		<hr/>	
	3.27366		2.43977
	sec.		"
	5.75+		39.2 N.
	1 38 22.24+		8 55 33.9 N.
<hr/>		<hr/>	
R. A. 1 38 28.0		Decl. 8 56 13.1 N.	

To take out the Equation of Time.

(190.) Get a Gr. date as in Art. 185, or as in note thereto. Take from the Nautical Almanac (p. II.) the equation of time for mean noon of the given day, and mark it A when *additive to Apparent Time*, and S when *subtractive from Apparent Time**. Proceed then as in taking out the sun's declination: using p. 16 of Naut. Tables.

Ex. Required the equation of time for the following dates in mean time: (1) Ship, April 3, 1^h 20^m A.M. in longitude 62° 30' E. (2) Ship, April 15, 10^h 45^m P.M. in longitude 53° 45' W.

(1)	(2)
Ship, April 2, 13 ^h 20 ^m	Ship, April 15, 10 ^h 45 ^m
Long. in T. 4 10 E.	Long. in T. 3 35 W.
Gr. April 2, 9 10	Gr. April 15, 14 20
Eq. T. April 2, 3 ^m 42 ^s .80 A.	April 15, 0 ^m 4 ^s .30 A.
3, 3 24 .74 A.	16, 0 10 57 S.
18 .06 S.	14.87 S.
2.77815	2.86024 Naut. Tab.
.41800	.22387 p. 16.
3.19615	3.08411
0 ^m 6 ^s .9 S.	0 ^m 8 ^s .9 S.
3 42.8 A.	0 4.3 A.
3 35.9 A.	0 4.6 S.

The proportional part of the equation of time, and also that of moon's semid. and hor. par., may also be taken from table of prop. parts. (See opp. p. to 216, in Naut. Tables.)

To take out the Right Ascension of the Mean Sun.†

(191.) This may be taken out precisely in the same manner as the right ascension of the true sun (see Art. 187.) Or it may be taken out perhaps more readily and exactly thus:

To the right ascension of the mean sun at the mean noon preceding the reduced Greenwich date, add the increase of the mean sun's right ascension for the hours, for the minutes, and for the seconds of the Greenwich date (see Naut. Tables, p. 12*); the sum (diminished by 24^h if greater than 24^h) will be the right ascension required.

* This is known from heading of Equation of Time in page I of Nautical Almanac for each month. Care must be taken not to use the heading (as at present) in page II, which it would be useful perhaps to erase, and to mark each Equation of Time from page I with letter A or S as applied to Apparent Time to get Mean Time.

† The right ascension of the mean sun is found in the Nautical Almanac under the head *Sidereal Time*. In the computations of Nautical Astronomy it is an element of very extensive use for general purposes, and the words "R. A. Mean Sun" might be added to the heading, as at present, with advantage.

Ex. Required the right ascension of the mean sun for the following date, Ship, Dec. 6, 1834, at 0^h 46^m, in longitude 135° 7' 30'' E.

Ship, Dec. 5, 24 ^h 46 ^m 0 ^s	Dec. 5, 16 ^h 55 ^m 13 ^s .12
Long. in T. 9 0 30 E.	For 15 ^h 2 27.847
	For 45 ^m 7.393
Gr. Dec. 5, 15 45 30	For 30 ^s 0.082
	<hr/> R. A. req ^d . 16 57 48.44

To take out the Moon's Declination and Right Ascension.

(192.) Get a Gr. date as in Art. 185, or as in note thereto. Take out the moon's declination for the hour immediately preceding the Greenwich date, and under it write down the moon's declination at the hour immediately following the Greenwich date, marking each with its proper sign N. or S. When the signs are *like*, take the *difference*, marking it with the name of either when the latter is the greater, and with a contrary name to either when the latter is the less. When the names are *unlike*, take the *sum*, marking it with the name of the latter.

To the *logistic logarithm* of the result (Naut. Tables, p. 13*) add the *logistic logarithm* of the minutes and seconds in the Greenwich date. The sum will be the *logistic logarithm* of the proportional part sought; which part mark with the name of the hourly difference. The sum of this proportional part and the first declination taken out, when their names are *like*, will be the declination required of the same name: their difference, when the names are *unlike*, will be the declination required, having the name of the greater.

(193.) The same rule may be used for finding the moon's right ascension from the Nautical Almanac, by marking those put down for the preceding and following hour with the sign +, adding 24 hours to the latter, when required to make it greater than the former; and rejecting 24 hours from the resulting right ascension, when it is greater than 24 hours.

Ex. Required the moon's right ascension and declination for Ship, Dec. 7, 1834, at 5^h 40^m 26^s mean time, in longitude 30° W.

Ship, Dec. 7, 5 ^h 40 ^m 26 ^s	Decl. Dec. 2, at 7, 11 42 5.5 S.	R.A. 23 4 5.84+
Long. in T. 2 0 0 W.	8, 11 30 29.3 S.	23 6 1.64+
Gr. Dec. 7, 7 40 26	11 36.2 N.	1 55.80+
.71369	1.49185	
.17141	.17141	
<hr/> .88510	<hr/> 1.66326	
0° 7' 49'' N.	1 ^m 18 ^s +	
11 42 5.5 S.	23 4 6 +	
<hr/> Decl. 11 34 16.5 S.	<hr/> R. A. 23 5 24	

(194.) In the above rule, it is supposed that the moon's right ascension and declination are wanted only to the nearest second of time or space. When they are wanted with the greatest accuracy, the proportional part may be easily computed from the difference for one hour by the rule of practice. The equation of second differences may also be found by applying the rule given hereafter. But such extreme accuracy can seldom be required in the operations of nautical astronomy, for which the above rule will be found the most convenient, and also sufficiently exact.

To take out the Moon's Horizontal Semidiameter and Horizontal Parallax.

(195.) Get a Gr. date as in Art. 185, or as in note thereto. Take out of the Nautical Almanac that semidiameter which is found at the mean noon or midnight immediately preceding the Greenwich date, and write under it that which is found at the mean midnight or noon immediately following the Greenwich date: marking each with the sign +. Take the difference and mark it + when the latter is the greater, and — when the latter is the less. To the *proportional logarithm* of this difference to the tenth of second (see Naut. Tab. p. 16) add the *Gr. date logarithm for the moon* (Naut. Tab. p. 13) corresponding to the hours and minutes of the Greenwich date, or if the date be more than 12^h, the hours and minutes above 12^h. The sum will be the *proportional logarithm* of the part required, which take from Naut. Tab. p. 16, and mark it with the same sign + or — that the whole difference above has. When the sign is + add it to the first semidiameter put down; when the sign is — subtract it therefrom. The result will be the semidiameter required.

The horizontal parallax is taken out in a similar manner.

Ex. Required the moon's horizontal semidiameter and horizontal parallax for the following date. Ship Dec. 5, 1834, at 6^h 36^m A.M. mean time, in longitude 45° E.

		Hor. Sem.	Hor. Par.
Sh. Dec. 4, 18 ^h 36 ^m	Dec. 4, at Gr. Midn.	15' 33".9+	57' 7".1+
Long. in T. 3 0 E.	Dec. 5, at Gr. Noon.	15 26 .7+	56 40 .8+
<hr/>			
Gr. Dec. 4, 15 36		7 .2—	26 .3—
3.17609		2.61347	
.52288		.52288	
<hr/>		<hr/>	
3.69897		3.13635	
2".2—		7".9—	
15 33 .9+		57 7 .1+	
<hr/>		<hr/>	
Hor. Sem. 15 31 .7		Hor. Par. 56 59 .2	

The required proportional part may be easily got also by the rule of practice, taking aliquot parts of 12 hours, or by page opp. to p. 216 of Naut. Tables.

Equation of Second Differences.

(196.) By the rules given above, different elements may be taken from the Nautical Almanac with sufficient accuracy for the general purposes of nautical astronomy. Should greater accuracy be necessary, it is to be attained by applying to the result of the first proportion accurately got, the equation of second differences. The mode of taking this from the table and applying it is as follows:—

Take from the Nautical Almanac the two elements or quantities immediately preceding the given Greenwich date, and the two immediately following, prefixing to each its proper name or sign, and when no name is given using +.

If the second of the quantities put down be greater than the first, and they have both the same name, put down their difference with the name of either; if the second be less than the first, and they have both the same name, put down their difference with a name different from that of either: if the two quantities have different names, put down their sum with the name of the latter. A similar rule must be followed for the second and third quantities put down, and for the third and fourth. Afterwards, take the difference of these first *differences* in a similar manner, marking the results as directed. Then if the two last results have the same name, take *half* their sum and give it the name of either; if they have different names, take *half* their difference and give it the name of the greater. This call the *mean second difference*.

Enter a table of second differences* with the hours and minutes of the Greenwich date (after the time of the preceding element taken out) at the side, and with the mean second difference at the top, first the minutes and then the seconds. The sum of the parts taken out will be the *equation of second differences*, to which prefix a contrary sign to that of the mean second difference.

Then from the middle first difference compute accurately the first proportional part as usual by the proper rule given for the particular case, prefixing the name of the middle first difference. Under this put the equation of second differences, and if the names be like, take the *sum* with the name of either; if the names be unlike, take the *difference* with the name of the greater. The result will be the proportional part to be applied to the second quantity taken from the Nautical Almanac.

If the quantity be the moon's right ascension or declination taken from the Nautical Almanac for each successive hour, or the moon's distance from the sun or a fixed star put down for every three hours, the mean second difference multiplied by the *Tabular Number* (see Nautical Tables, p. 12*) will be the equation of second differences.

From Ship Mean Time to find Ship Sidereal Time or Right Ascension of Meridian.

(197.) Get a Gr. date as in Art. 185, or the note thereto. For this date take out of the Nautical Almanac (p. II of each month) the *right ascension of mean sun* (note Art. 191) by rule Art. 191. Add this so taken out to *ship mean time* expressed astronomically: the sum (rejecting 24^h

* The one in Naut. Tables is for intervals of 12 hours.

if greater than 24^h) will be sidereal time or right ascension of meridian (see App. 12).

Ex. 1. Ship May 10, 1834, $4^h 25^m 15^s.7$ P.M. mean time, longitude $71^\circ 15' 30''$ E.: required sidereal time. R. A. of mean sun on May 9, at Gr. mean noon $3^h 7^m 16^s.44$; on May 10, $3^h 11^m 13^s.00$.

Ex. 2. Ship Dec. 21, 1834, $2^h 55^m 19^s.2$ A.M. mean time, longitude $45^\circ 45' 15''$ W.: required sidereal time. R. A. of mean sun on Dec. 20, at Gr. mean noon $17^h 54^m 21^s.50$; on Dec. 21, $37^h 58^m 18^s.05$.

(1.)				(2.)			
Ship, May 9 . . .	28 ^h	25 ^m	15 ^s .7	Ship, Dec. 20 . . .	14 ^h	55 ^m	19 ^s .2
Long. in T. . . .	4	45	2 E.	Long in T. . . .	3	3	1 W.
<hr/>				<hr/>			
Gr. May 9 . . .	23	40	13.7	Gr. Dec. 20 . . .	17	58	20.2
<hr/>				<hr/>			
R. A. mean Sun . .	3	11	9.75	R. A. mean Sun . .	17	57	18.64
Ship, May 10 . . .	4	25	15.7	Ship, Dec. 20 . . .	14	55	19.2
<hr/>				<hr/>			
Sid. T.	7	36	25.45	Sid. T.	8	52	37.84

From Ship Sidereal Time or Right Ascension of Meridian to find Ship Mean Time.

(198.) Get a Gr. date as in Art. 185, or as in note thereto. For this date take from the Nautical Almanac the *right ascension of mean sun* (see note, Art. 191). which subtract from the *given sidereal time* (increased by 24^h if less than the right ascension of mean sun): the remainder will be ship mean time. (See App. 12.)

If the assumed ship mean time has been erroneous, repeat the operation, using the last resulting ship mean time for estimated ship mean time.

Ex. 1. Ship May 10, 1834, at $4^h 10^m$ P.M. (mean time nearly), in longitude $80^\circ 15' 30''$ E., sidereal time was $7^h 36^m 25^s.4$: required correct ship mean time. R. A. of mean sun on May 9 at Gr. mean noon $3^h 7^m 16^s.44$; on May 10, $3^h 11^m 13^s.0$.

Ex. 2. Jan. 3, 1834, at 6^h A.M. (mean time nearly), in longitude $110^\circ 30'$ W., sidereal time was $0^h 50^m 12^s.5$: required correct ship mean time. R. A. mean sun on Jan. 3, at Gr. mean noon $18^h 50^m 30^s.58$; on Jan. 4, $18^h 54^m 27^s.13$.

(1.)				(2.)			
Sh. May 9	28 ^h	10 ^m	0 ^s	Sh. Jan. 2	18 ^h	0 ^m	0 ^s
Long. in T. . . .	5	21	2 E.	Long. in T. . . .	7	22	0 W.
<hr/>				<hr/>			
Gr. May 9	22	48	58	Gr. Jan. 3	1	22	0
<hr/>				<hr/>			
R. A. mean Sun. . .	3 ^h	11 ^m	1 ^s .3	R. A. mean Sun. . .	18 ^h	50 ^m	44 ^s .0
S. T.	7	36	25.4	S. T.	24	50	12.5
<hr/>				<hr/>			
Sh. mean T. . . .	4	25	24.1	Sh. mean T. . . .	5	59	28.5
By repetition . . .	4	25	20.7				

From Ship Mean Time to find the Hour Angle in Time of a Heavenly Body.

(199.) Get a Gr. date as in Art. 185, or as in note thereto. For this Greenwich date take from the Nautical Almanac the right ascension of the mean sun (note Art. 191); also the right ascension of the heavenly body. Add together *ship mean time* (expressed astronomically) and the *right ascension of the mean sun*: from the sum, increased if necessary by 24^h , subtract the *right ascension of the heavenly body*: the remainder, diminished by 24^h if greater than 24^h , will be the hour angle in time *west* of meridian. If the hour angle be wanted *east* of meridian, subtract the hour angle thus found from 24^h . (See App. 13.)

Ex. 1. Ship, Dec. 10, 1834, at $9^h 10^m 42^s$ P.M. mean time, in longitude $72^\circ 25' 30''$ E.; required the hour angle in time of α Tauri (Aldebaran). R. A. mean sun on Dec. 10 at Gr. mean noon $17^h 14^m 55^s.91$; on Dec. 11, $17^h 18^m 52^s.47$. R. A. α Tauri $4^h 26^m 27^s.6$.

Ex. 2. Ship, Oct. 17, 1834, at $0^h 40^m 15^s$ A.M. mean time, in longitude $110^\circ 20' W.$; required the hour angle of the moon. R. A. mean sun on Oct. 16 at Gr. mean noon $13^h 38^m 5^s.34$; on Oct. 17, $13^h 42^m 1^s.89$. R. A. moon, Oct. 16 at 20^h , $1^h 19^m 11^s.66$; at 21^h , $1^h 20^m 59^s.47$.

(1.)				(2.)			
Sh. Dec. 10 . .	9 ^h	10 ^m	42 ^s	Sh. Oct. 16 . .	12 ^h	40 ^m	15 ^s
Long. in T. . .	4	49	42 E.	Long. in T. . .	7	21	20 W.
<hr/>				<hr/>			
Gr. Dec. 10 . .	4	21	0	Gr. Oct. 16 . .	20	1	35
R. A. mean Sun	17	15	38.8	R. A. mean Sun.	13	41	22.73
Sh. mean T. . .	9	10	42	Ship mean T. . .	12	40	15
<hr/>				<hr/>			
S. T.	26	26	20.8	S. T.	26	21	37.73
R. A. α Tauri .	4	26	27.6	R. A. moon . .	1	19	14.5
<hr/>				<hr/>			
Hour angle . .	21	59	53.2 W.	Hour angle . . .	1	2	23.2 W.
Or	2	0	6.8 E.	[rejecting 24^h]			

From Ship Mean Time to find the Hour Angle in Time of the Sun.

(200.) Get a Gr. date as in Art. 185, or as in note thereto. For this Greenwich date take from the Nautical Almanac the equation of time with its proper sign (Art. 190), putting A for *additive* and S for *subtractive*. When the equation of time is *additive*, subtract it from ship mean time expressed astronomically (adding 24^h if necessary); when the equation of time is *subtractive*, add it to ship mean time expressed astronomically: the result (rejecting 24^h if greater than 24^h) will be the hour angle in time *west* of meridian.

If the hour angle of the sun be required *east* of meridian, subtract the result from 24 hours.

Ex. 1. Jan. 10, 1834, at $3^h 10^m 15^s$ P.M. (mean time) in longitude $100^\circ 20'$ E., required the hour angle (in time) of the sun *west* of meridian, Equation of Time on Jan. 9 at Gr. mean noon $7^m 24^s.19$ A.; on Jan. 10, $7^m 48^s.91$ A.

Ex. 2. Oct. 16, 1834, at $9^h 50^m 26^s$, A.M. (mean time) in longitude $73^\circ 46'$ W.: required the hour angle in time of the sun *west* of meridian, also *east* of meridian. Equation of Time on Oct. 16, at Gr. mean noon $14^m 17^s.9$ S.; on Oct. 17, $14^m 30^s.3$ S.

(1.)		(2.)	
Sh. Jan. 9 . .	$27^h 10^m 15^s$	Sh. Oct. 15 . .	$21^h 50^m 26^s$
Long. in T. . .	6 41 20 E.	Long. in T. . .	4 55 4 W.
<hr/>		<hr/>	
Gr. Jan. 9 . .	20 28 55	Gr. Oct. 16 . .	2 45 30
Eq. T.	7 45.3 A.	Eq. T.	14 19.3 S.
Sh. mean T. . .	3 10 15	Sh. mean T. . .	21 50 26
<hr/>		<hr/>	
Hour angle . .	3 2 29.7 W.	Hour angle . .	22 4 45.3 W.
		Or	1 55 14.7 E.

From the Hour Angle of a Heavenly Body to find Ship Mean Time.

HOURLY ANGLE WEST OF MERIDIAN.

(201.) Get a Gr. date as in Art. 185, or as in note thereto. For this date take from the Nautical Almanac the right ascension of the mean sun (Art. 191), and also the right ascension of the heavenly body. To the *hour angle* (supposed west of meridian) add the *right ascension of the body*: the sum will be sidereal time or right ascension of meridian. From this (increased if necessary by 24^h) subtract the *right ascension of the mean sun*: the remainder will be ship mean time. (See App. 13.)

When the resulting ship mean time differs considerably from that assumed in getting a Greenwich date, go through the work again with the resulting ship mean time instead of that first estimated.

HOURLY ANGLE EAST OF MERIDIAN.

Subtract the hour angle from 24^h ; the remainder may be considered as an hour angle *west* of meridian: proceed with this remainder as in the last case.

Ex. 1. Ship, Dec. 12, 1834, at $1^h 6^m$ A.M. mean time nearly, in longitude $65^\circ 25'$ E., the hour angle of α Taurus (Aldebaran) was $2^h 0^m 6^s.6$ W.: required correct ship mean time. R. A. mean sun on Dec. 11 at Gr. mean noon $17^h 18^m 52^s.47$; on Dec. 12, $17^h 22^m 49^s.03$; R. A. α Taurus, $4^h 26^m 27^s.6$.

Ex. 2. Ship, Jan. 3, 1834, at $0^h 9^m$ A.M. (mean time nearly), in longitude $111^\circ 30'$ E., the hour angle of the moon was $5^h 56^m 8^s.7$ E.: required correct ship mean time. R. A. mean sun on Jan. 2 at Gr. mean noon $18^h 46^m 34^s.02$, on Jan. 3, $18^h 50^m 30^s.58$; R. A. of moon on Jan. 2, at 4^h , $12^h 51^m 25^s.42$; at 5^h , $12^h 53^m 34^s.26$.

(1.)				(2.)			
Sh. Dec. 11	. .	13 ^h	6 ^m 0 ^s	Sh. Jan. 2	. .	12 ^h	9 ^m 0 ^s
Long. in T.	. .	4	21 40 E.	Long. in T.	. .	7	26 0 E.
<hr/>				<hr/>			
Gr. Dec. 11	. .	8	44 20	Gr. Jan. 2	. .	4	43 0
<hr/>				<hr/>			
Hour Angle	. .	2	0 6.6 W.	Hour Angle	. .	18	3 51.3 W.
R. A. α Taurus.	. .	4	26 27.6	R. A. Moon	. .	12	52 57.5
<hr/>				<hr/>			
Adding 24 ^h	. .	30	26 34.2			30	56 48.8
R. A. mean Sun	. .	17	20 18.6	R. A. mean Sun	. .	18	47 20.5
<hr/>				<hr/>			
Sh. mean T.	. .	13	6 15.6	Sh. mean T.	. .	12	9 28.3

From the Hour Angle in Time of the Sun WEST of Meridian, or Apparent Time, to find Ship Mean Time.

(202.) The rule given in the last article may be applied to the hour angle of the sun, but the following rule will be more easy.

Get a Gr. date as in Art. 185, or as in note thereto. For this Greenwich date take from the Nautical Almanac the equation of time with its proper sign A. or S. (see Art. 190). Apply this *equation of time* to the given *hour angle* with its proper sign (adding 24^h if necessary): the result (rejecting 24^h if greater than 24^h) will be ship mean time.

If the hour angle (in time) of the sun be given *east* of the meridian, subtract it from 24^h to get the hour angle *west* of meridian or apparent time, with which proceed as above.

Ex. 1. Ship, April 10, 1834, at 3^h 10^m P.M. mean time nearly, in longitude 38° 6' 30'' W. the hour angle of the sun W. or app. time was 3^h 9^m 25^s.7; required correct ship mean time. Eq. T. on April 10, at Gr. mean noon 1^m 23^s.39 A.; on April 11, 1^m 7^s.0 A.

Ex. 2. Oct. 16, 1834, at 10^h 25^m A.M. mean time nearly, in longitude 52° 10' E. the hour angle of the sun W. or app. time was 22^h 39^m 45^s; required correct ship mean time. Eq. T. on Oct. 15 at Gr. mean noon 14^m 4^s.93 S.; on Oct. 16, 14^m 17^s.9 S.

(1.)				(2.)			
Sh. April 10	. .	3 ^h	10 ^m	Sh. Oct. 15	. . . .	22 ^h	25 ^m
Long. in T.	. . . .	2	32 W.	Long. in T.	. . . .	3	29 E.
<hr/>				<hr/>			
Gr. April 10	. . . .	5	42	Gr. Oct. 15	. . . .	18	56
<hr/>				<hr/>			
Eq. T.	. . . . .	1 ^m	19 ^s .5 A.	Eq. T.	. . . . .	14 ^m	15 ^s .2 S.
Hour Angle	. .	3	9 25.7	Hour Angle	. .	22	39 45
<hr/>				<hr/>			
Sh. M. T.	. .	3	10 45.2	Sh. M. T.	. .	22	25 29.8

To find Ship Mean Time when any Heavenly Body is on the Meridian.

(203.) Get a Gr. date* as in Art. 185, or as in note thereto. For this Greenwich date take from the Nautical Almanac the right ascension of

* Ship mean time may be known nearly by subtracting the right ascension of mean sun taken out of the Nautical Almanac by inspection for the estimated nearest noon, from the right ascension of the heavenly body, increased if necessary by 24 hours.

mean sun (Art. 191), and the right ascension of the heavenly body, which at the instant of its meridian passage is the right ascension of the meridian or sidereal time. From the *right ascension of the heavenly body*, increased if necessary by 24^h , subtract the *right ascension of mean sun*. The remainder will be ship mean time. (See App. 12.)

When the M. T. of the inferior meridian passage is required: find a Gr. date as in Art. 185, or as in note thereto (the ship M. T. being known nearly by adding 12^h to the time of the superior mer. passage*). For that date take from the Naut. Almanac the R. A. of the body, to which add 12^h . Take out also the R. A. of the mean sun. Subtract the latter from the former, adding 24^h to the former if the less of the two. The result will be the M. T. required.

For the sun, the M. T. of the inferior meridian passage is got by applying to 12^h the equation of time, taken out for Gr. date, with its proper sign, that is, its sign as applied to apparent time. (See Art. 190.)

If the result differ much from the first estimated ship mean time, the work must be repeated, using the resulting time for estimated ship time.

Ex. 1. Ship, June 1, at $2^h 57^m$ P.M. mean time nearly, in longitude $65^\circ 15'$ E., required the ship mean time of the meridian passage of β Gemini (Pollux). R. A. mean sun on May 31, at Gr. mean noon $4^h 34^m 0^s.68$, on June 1, $4^h 37^m 57^s.24$. R. A. of β Gemini $7^h 35^m 8^s.0$.

Ex. 2. Ship, Feb. 21, 1834, at $0^h 1^m$ A.M. mean time nearly, in longitude $150^\circ 30'$ W., required the ship mean time of the meridian passage of α Leo (Regulus). R. A. M. sun on Feb. 20, at Gr. mean noon, $21^h 59^m 45^s.26$, on Feb. 21, $22^h 3^m 41^s.82$; R. A. of α Leo $9^h 59^m 32^s.3$.

(1.)			
Sh. May 31 . . .	$26^h 57^m$		
Long. in T. . . .	4	21 E.	
<hr/>			
Gr. May 31 . . .	22	36	0
<hr/>			
R. A. β Gem. . . .	7	35	8.0
R. A. M. Sun. . . .	4	37	43.4
<hr/>			
Sh. mean T. . . .	2	57	24.6

(2.)			
Sh. Feb. 20 . . .	$12^h 1^m$		
Long. in T. . . .	10	2 W.	
<hr/>			
Gr. Feb. 20 . . .	22	3	0
R. A. α Leo. . . .	33	59	32.3
R. A. M. Sun. . . .	22	3	22.6
<hr/>			
Sh. mean T. . . .	11	56	9.7
<hr/>			
Work repeated . .	11	56	5.1

To find Ship Mean Time when the Sun is on the Meridian, or the Ship Mean Time of Apparent Noon.

(204.) Get a Gr. date* as in Art. 185, or as in note thereto. For this Greenwich date take from the Nautical Almanac the equation of time. When *additive* (see note to Art. 190) add the *equation of time* to $0^h 0^m 0^s$, and the result will be ship mean time on the given day: when *subtractive*,

* To get ship mean time nearly, the eq. of time may be taken out at the estimated nearest Greenwich mean noon. If additive, add it to 0h. 0m. 0s., and put the given day; if subtractive, subtract it from 24 hours, and put the preceding day to the given one.

subtract it from 24^h , and the result will be ship mean time, putting the day one back.

Ex. 1. Required the ship mean time, when the sun passed the meridian on Oct. 15, 1834, in longitude $75^\circ 15' W.$; and also on Jan. 28, 1834, in longitude $25^\circ 10' E.$ Eq. T. on Oct. 15, at Gr. mean noon, $14^m 4^s.93 S.$; on Oct. 16, $14^m 17^s.90 S.$; on Jan. 27, $13^m 4^s.24 A.$; on Jan. 28, $13^m 15^s.84 A.$

(1.)		(2.)	
Sh. Oct. 14 . . .	$23^h 46^m$	Sh. Jan. 27 . . .	$24^h 13^m$
Long. in T. . . .	5 1 W.	Long. in T. . . .	1 41 E.
<hr/>		<hr/>	
Gr. Oct. 15 . . .	4 47	Gr. Jan. 27 . . .	22 32
	24 0 0		0 0 0
Eq. T.	14 7.4 S.	Eq. T.	13 15.1 A.
<hr/>		<hr/>	
Sh. M. T. Oct. 14,	23 45 52.6	Sh. M. T. Jan. 28,	0 13 15.1

(205.) The ship mean time of the meridian passage of a planet or the moon may be found correctly as in Art. 203. But for many purposes that of a planet may be taken out by inspection from the Nautical Almanac for the nearest Greenwich mean noon; and that of the moon with sufficient accuracy as follows:—

For the Moon: take the Greenwich mean time of the moon's meridian passage from the Nautical Almanac on the given day *expressed astronomically* (see Art. 162); also take out the difference between this and the following meridian passage when the longitude is W., and the difference between this and the preceding one when the longitude is E. With this difference and the longitude enter Naut. Tab. (*k*), p. 5, and take out the corresponding correction, which *add* to the time of Greenwich meridian passage in W. longitude, and *subtract* it in E. longitude. The result will be the ship mean time of meridian passage.

Ex. 1. Required the ship mean time of moon's meridian passage on July 19, 1834 (astronomical day), in longitude $60^\circ W.$; and on July 27, 1834 (astronomical day), in longitude $175^\circ E.$

(1.)		(2.)	
Gr. mer. pass. July 19, 11	$24.3^h +$	Gr. mer. pass. July 27, 17	$30.1^h +$
20, 12	$19.2^h +$	26, 16	$49.5^h +$
<hr/>		<hr/>	
Diff.	54.9+	Diff.	40.6—
Tab. Corr.	9 +	Tab. Corr.	19 —
<hr/>		<hr/>	
Sh. mer. pass. July 19, 11	33.3	Sh. mer. pass. July 27, 17	11.1
		Or July 28	5 11.1 A.M.

To find the Meridian Zenith Distance of a Heavenly Body.

(206.) Get a Gr. date as in Art. 185, or as in note thereto. For this take from the Nautical Almanac the declination of the heavenly body. Under the *latitude* of the place put the *declination*, marking each with its

proper sign N. or S. When the names are *like*, take the difference; marking it with the *common* name if the declination be the greater; and with a *contrary* sign to the common one if the declination be the less. When the names are *unlike*, take the sum, and put to it the name of the declination. The result in every case will be the meridian zenith distance N. or S. of the zenith. (See App. 14.)

(1.)	(2.)	(3.)
Lat. 20° 48' 0" N.	Lat. 50° 48' 0" N.	Lat. 22° 15' 0" S.
Decl. 25 25 17.5 N.	Decl. 28 25 17 N.	Decl. 12 46 30 N.
<hr/>	<hr/>	<hr/>
M. Z. 4 37 17.5 N.	M. Z. 22 22 43 S.	M. Z. 35 1 30 N.

To find what principal Stars will pass the Meridian between any given Ship Dates in Mean Time.

(207.) For each given ship mean time get a Greenwich date as in Art. 185, or as in note thereto. For each date take from the Nautical Almanac the right ascension of mean sun (Art. 191). Add together each *ship mean time* and the corresponding *right ascension of mean sun* (rejecting 24^h from either sum if greater than 24^h). Then all the stars in the catalogue of the Nautical Almanac whose right ascensions are found to be between the two results taken in order as limits, will pass the meridian between the given ship times. (See App. 12.)

Ex. What principal fixed stars will pass the meridian in longitude 75° 15' W. between 11^h P.M. on Oct. 24, 1834, and 1^h 1^m A.M. on Oct. 25? R. A. M. Sun on Oct. 24, at Gr. noon 14^h 9^m 37^s.77, on Oct. 25, 14^h 13^m 34^s.32.

Sh. Oct. 24 . . . 11 ^h 0 ^m	Sh. Oct. 24 . . . 13 ^h 0 ^m
Long. in T. . . . 5 1 W.	Long. in T. . . . 5 1 W.
<hr/>	<hr/>
Gr. Oct. 24 . . . 16 1	Gr. Oct. 24 . . . 18 1
R. A. M. Sun . . 14 ^h 12 ^m 15 ^s .6	R. A. M. Sun . . 14 ^h 12 ^m 35 ^s .3
Sh. M. T. . . . 11 0 0	Sh. M. T. . . . 13 1 0
<hr/>	<hr/>
R. A. Mer. . . . 1 12 15 .6.	R. A. Mer. . . . 3 13 35 .3

The required stars are from θ Cetus to α Perseus inclusive.

forward on the arc the moveable radius, and thereby turns round the central glass C, till a ray of light coming from the heavenly body is reflected by it to the fixed glass D, which again reflects the same ray to the eye; so that it enters the eye in the same line as a ray coming from the before-mentioned point A of the horizon viewed directly.

The effect is, that the heavenly body is seen at this point. The degrees, &c., through which the index on the moveable radius has been carried on the arc is then read off: this reading off is *nearly* the apparent altitude of the body. There may be two reasons why it is not so *exactly*. First, the divisions on the arc should commence from the point where the index stands, when the two reflectors are parallel, which is seldom the case. Hence it happens, that the reading off may be something too great or too little. The necessary correction is called the *index correction*, and is sometimes additive (+) and sometimes subtractive (—). Secondly, it must be considered, that the apparent altitude is the angular distance of the body from a horizontal plane passing through the observer's eye; whereas its elevation is taken above a point of the sea, which lies a little below the level of the eye. The observed altitude therefore must on this account be too great. The necessary corrections for different heights of the eye are computed, and put in a table under the name of *dip of the horizon*, whence they may be taken by inspection (see Nautical Table (e), p. 3).

When the sun is observed, the altitude of the lower limb is usually taken: this being corrected for index correction and dip, we have the apparent altitude of the lower limb. To this the sun's semidiameter taken from the Nautical Almanac being added, we have the apparent altitude of the centre (A.A.). In this case, therefore, the sun's semidiameter may be considered as a third correction. When the moon is observed, sometimes the altitude of the lower limb is taken, and sometimes that of the upper limb: in the former case the moon's semidiameter must be added, and in the latter subtracted.

The observed altitude, after being corrected as above, is afterwards farther corrected for parallax and refraction, as in Art. 130. The result is the true altitude (T.A.).

To find the Latitude by the Meridian Altitude of a Heavenly Body.

(209.) The meridian altitude of a heavenly body is observed at sea as follows. About a quarter of an hour before the heavenly body will be on the meridian, the observer goes on deck and takes its altitude (208): in a minute or two he again looks at the point of the horizon under the body without altering the place of the index on his instrument; and if the altitude has increased, the point of the image that before touched the horizon will now be separated a little from it. Should this be the case, he pushes forward the index till a fresh contact is made.

A similar process is gone through till the altitude increases very slowly, and the separation of the image from the horizon is scarcely perceptible. This shews that the body is very nearly on the meridian; and it is then necessary to make the contact with greater nicety, to examine it constantly, and if the slightest new separation appear, to alter the index very gradually and carefully by the tangent screw, till at length the image is quite stationary. The body is at that instant on the meridian, after passing which its altitude will diminish and the image will appear to dip a little

below the horizon. The observer usually waits till this is the case, taking care not to alter the index after the stationary appearance of the image, unless it again rise: he then reads off the degrees, minutes, and seconds on the arc, and thus gets the observed meridian altitude of the body, or rather of that point of the body which is made to touch the horizon. This being corrected for the index correction of the instrument, dip, semidiameter, refraction, and parallax, the true altitude is deduced; and by subtracting the true altitude from 90° the true *zenith distance* is found. Now if we know the declination of the body, or the distance of the body from the equator, and also, as above, its meridian distance from the zenith, it is manifest that we can find, from these two arcs, the distance of the equator from the zenith, or the latitude.

(210.) **RULE.** Get a Gr. date as in Art. 185, or as in note thereto. For this date take from the Nautical Almanac:

- (1.) *For Sun*; the declination and semidiameter as in Art. 186.
- (2.) *For Moon*; the declination, hor. semidiameter, and hor. parallax as in Arts. 192, 195.
- (3.) *For Planet*;* the declination as in Art. 189.
- (4.) *For Fixed Star*; the declination.

(211.) Correct the observed meridian altitude as follows:

- (1.) *For Sun*; index correction + or - according to its sign; dip -; semidiameter + (L. L. being observed); parallax and refraction -.
- (2.) *For Moon*; index correction + or -; dip -; semidiameter + when L. L. observed; - when U. L. observed; parallax and refraction +.
- (3.) *For Planet*, its centre being observed; index correction + or -; dip -; refraction as for a fixed star -; in strictness for parallax +.
- (4.) *For Fixed Star*; index correction + or -; dip -; refraction -.

Take the result from 90° and call it M. Z. (meridian zenith distance), N. when the zenith is *north* of the body, and S. when the zenith is *south* of the body.

Put under M. Z. the declination with its proper name N. or S. If the names be *like*, take the *sum*, which will be the latitude of the same name with either: if the names be *unlike*, take the *difference*, which will be the latitude having the name of the greater. (See App. 14.)

* The centre of the planet, as nearly as the eye can judge, is supposed to be brought down to the horizon. The small correction for parallax *additive*, which would require the hor. parallax (see Naut. Tables), is here supposed to be neglected.

Ex. 1. Oct. 25, 1834, at 11^h 44^m A.M. (see note Art. 204), in longitude 43° 30' W. the observed meridian altitude of the sun's L. L. was 43° 25' 10'' zenith S. of sun; the index correction was — 2' 10'', and the height of the eye above the sea was 16 feet: required the latitude. Decl. on Oct. 25 at Gr. mean noon 12° 2' 42'' S.; on Oct. 26, 12° 23' 23'' S.; semid. 16' 7''.

Ex. 2. Sept. 17, at 11^h 59^m P.M. mean time nearly, in longitude 84° 40' W. the observed meridian altitude of the moon's U. L. was 39° 25' 40'' zenith N. of moon; the index correction was + 2' 50'', and the height of the eye above the sea was 0 feet: required the latitude. Decl. on Sept. 17, at 17^h, 5° 35' 34''.3 S., at 18^h, 5° 23' 24''.6 S.; hor. semid. on Sept. 17 at Gr. mean midn. 14' 45''.9, on Sept. 18 at Gr. mean noon 14' 44''.5; corresponding hor. par. 54' 11'' and 54' 5''.7.

(1.)

Sh. Oct. 24 . . . 23^h 44^m
Long. in T. . . . 2 54 W.

Gr. Oct. 25 . . . 2 38

Sun's decl. . . 12 4 58 S. Art. 186.

Obs. Alt. . . 43 25 10

Ind. Cor. . . . 2 10—

Obs. Alt. . . 43 23 0

Dip. . . . 3 56—

Semid. . . . 43 19 4
 16 7+

A. A. . . . 43 35 11

Refr. & Par. . . . 55—

T. A. . . . 43 34 16

M. Z. . . . 46 25 44 S.

Decl. . . . 12 4 58 S.

Lat. . . . 58 30 42 S.

(2.)

Sh. Sept. 17 . . 11^h 59^m
Long. in T. . . . 5 39 W.

Gr. Sept. 17 . . 17 38

Moon's decl. . . 5 27 52 S. Art. 192.

Hor. semid. . . 14 45.3

Hor. Par. . . . 54 8.5

Obs. Alt. . . 39° 25' 40

Ind. Cor. . . . 2 50+

Semid. Aug. . . 39 28 30

 14 54

A. A. . . . 39 13 36

Refr. & Par. { 40 39+
 7+

T. A. . . . 39 54 22

M. Z. . . . 50 5 38 N.

Decl. . . . 5 27 52 S.

Lat. . . . 44 37 46 N.

Ex. 3. Nov. 14, 1834, at 0^h 58^m A.M. mean time nearly, in longitude 75° 15' W., the observed meridian altitude of the planet Jupiter was 47° 10' 50'', zenith N. of planet; the index correction was — 4' 10'', and the height of the eye above the sea was 14 feet: required the latitude. Planet's decl. on Nov. 13 at Gr. mean noon 20° 53' 35''.1 N., Nov. 14, 20° 52' 29''.4 N.

Ex. 4. Oct. 25, 1834, the observed meridian altitude of α Aquila (Altair) was 34° 40' 10'', zenith S. of star; the index correction was — 3' 20'', and the height of the eye above the sea was 18 feet: required the latitude. Decl. α Aquila 8° 26' 19'' N.

(3.)		(4.)	
(1.)	Sh. Nov. 13 12 ^h 58 ^m	(2.)	Decl. . . . 8° 26' 19" N
	Long. in T. 5 1 W.		Obs. Alt. . . 34 40 10
			Ind. Cor. . . . 3 20—
	Gr. Nov. 13 17 59		
	Planet's Decl. . . . 20° 52' 45" N.		Obs. Alt. . . 34 36 50
	Obs. Alt. 47 10 50		Dip. 4 11—
	Ind. Cor. 4 10—		
			A. A. . . . 34 32 39
			Refr. 1 24—
	Dip. 3 41—		T. A. . . . 34 31 15
	A. A. 47 2 59		M. Z. . . . 55 28 45 S.
	Refr. (Par. neglected) 54—		Decl. . . . 8 26 19 N.
	T. A. 47 2 5		Lat. 47 2 26 S.
	M. Z. 42 57 55 N.		
	Decl. 20 52 45 N.		
	Lat. 63 50 40 N.		

(212.) Hadley's sextant is used in observing the double altitude of a heavenly body by means of an artificial horizon, as the surface of quiescent quicksilver, oil, water, or the surface of glass or polished metal rendered horizontal. This being placed on steady ground, the observer steps back from it till he sees distinctly below the surface the image of the heavenly body. Then holding the sextant with its plane in a circle of altitude passing through the body, he sweeps forward the index, and thus brings the image formed by the two glasses to coincide with or touch the one seen in the artificial horizon. The reading off he corrects for index correction, and divides the result by 2: the quotient is the apparent altitude of the body; of its lower limb (L. L.) or upper limb (U. L.) according to circumstances. (See explanation of Nautical Instruments.)

For the Sun. The L. L. of image reflected from the glasses is made to touch the U. L. of the image seen in the artificial horizon.* To the reading off the index correction is applied, then *half* the result is taken, to which the sun's semidiameter is added: the sum is A. A. of centre, from which subtracting the correction for refraction and parallax, the result is T. A. which is taken from 90° for the meridian zenith distance (M. Z.) From this and the declination, the latitude is got as in Art. 211.

For the Moon. When the L. L. of the moon is enlightened, proceed as for the sun, taking care to augment the hor. semidiameter from Nautical Almanac. When the U. L. is enlightened, the image formed by the glasses must be brought below the image seen in the artificial horizon, so that the U. L. of the former may touch the L. L. of the latter.* Having applied the index correction to the reading off, and divided by 2, the semidiameter (augmented) must be *subtracted* to get the A. A. The correction

* When an *inverting telescope* is used, the L. L., as it appears through the telescope, is in fact the U. L. for either image, and the L. L. *apparently* is in fact the L. L.

for refraction and parallax must then be added to get the T. A., which being subtracted from 90° the result is M. Z.; from which and the declination the latitude is found as in Art. 211.

For a Star or Planet. The image formed by the glasses must be brought to pass exactly over the image seen in the artificial horizon. Having applied the index correction to the reading off, and divided by 2, subtract the correction for refraction*: the result will be the T. A., whence get M. Z. as for the sun, and from this and the declination get the latitude.

Ex. 1. On Nov. 3, 1834, at $11^h 44^m$ A.M. mean time nearly, in longitude $36^\circ 29'$ W. the observed *double* meridian altitude of the sun's L. L. was $50^\circ 25' 30''$, zenith N. of the sun; the index correction was $+1' 50''$: required the latitude. Sun's decl. on Nov. 3 at Gr. mean noon $15^\circ 1' 20''$ 2 S., on Nov. 4, $15^\circ 20' 2.9$ S.; semid. $16' 9''$.

Ex. 2. On Nov. 3, 1834, the observed *double* meridian altitude of α Pavo was $160^\circ 25' 52''$ zenith N. of Star; the index correction was $+2' 10''$: required the latitude. Decl. of α Pavo on Nov. 3. $57^\circ 15' 36''$ S.

(1.)		(2.)	
Sh. Nov. 2 . . .	$23^h 44^m$	Nov. 3.	
Long. in T. . . .	$2\ 26\ W.$	Decl. α Pavo. . .	$57^\circ 15' 36''\ S.$
<hr/>		<hr/>	
Gr. Nov. 3 . . .	$2\ 10$	Obs. 2 Alt. . . .	$160\ 25\ 52$
Sun's Decl. . . .	$15^\circ\ 3'\ 1''\ S.$	Ind. Corr. . . .	$2\ 10\ +$
<hr/>		<hr/>	
Obs. 2 Alt. . . .	$50\ 25\ 30$	2) $160\ 28\ 2$	
Ind. Corr.	$1\ 50\ +$	<hr/>	
<hr/>		A. A.	$80\ 14\ 1$
2) $50\ 27\ 20$		Refr.	$10\ -$
<hr/>		<hr/>	
	$25\ 13\ 40$	T. A.	$80\ 13\ 51$
Semid.	$16\ 9\ +$	<hr/>	
<hr/>		M. Z.	$9\ 46\ 9\ N.$
A. A.	$25\ 29\ 49$	Decl.	$57\ 15\ 36\ S.$
Refr. & Par. . . .	$1\ 54\ -$	<hr/>	
<hr/>		Lat.	$47\ 29\ 27\ S.$
T. A.	$25\ 27\ 55$	<hr/>	
<hr/>		<hr/>	
M. Z.	$64\ 32\ 5\ N.$	<hr/>	
Decl.	$15\ 3\ 1\ S.$	<hr/>	
<hr/>		<hr/>	
Lat.	$49\ 29\ 4\ N.$	<hr/>	

Latitude by Meridian Altitude under Pole.

(213.) Sometimes the meridian altitude of a heavenly body may be observed at its inferior passage from W. to E. under the pole; in this case

* The parallax of planet is neglected. When it is necessary to attend to so small a correction, it must be added after refraction has been applied. (See Naut. Table (e), p. 2.)

the observed altitude previous to the meridian altitude diminishes, and the meridian altitude is the least. The rule for finding the latitude therefrom is the same nearly as in Arts. 210, 211, with this difference: instead of subtracting the true altitude (T. A.) from 90° , add it to 90° , and then subtract the declination. The result will be the latitude of the same name with the declination. (See App. 15.)

Ex. 1. On Jan. 20, 1834, at $0^h 11^m$ A.M. in longitude $92^\circ 30'$ E., the observed meridian altitude of the sun's L. L. under the south pole was $6^\circ 10' 40''$, the index correction was $+3' 40''$, and the height of the eye above the sea was 15 feet: required the latitude. Sun's decl. on Jan. 19 at Gr. mean noon $20^\circ 22' 27''.5$ S.; on Jan. 20, $20^\circ 9' 41''.6$ S.; semid. $16' 16''$.

Ex. 2. On Nov. 5, 1834, the observed meridian altitude of α Urs. Maj. (Dubhe) under the north pole was $10^\circ 46' 50''$; the index correction was $-1' 15''$, and the height of the eye above the sea was 16 feet: required the latitude. Decl. α Urs. Maj. $62^\circ 38' 23''$ N.

(1.)	
Sh. Jan. 19.	$12^h 11^m$
Long. in T.	$6\ 10\ E.$
<hr/>	
Gr. Jan. 19	$6\ 1$
Sun's Decl.	$20^\circ 19' 15''\ S.$
Obs. Alt.	$6\ 10\ 40$
Ind. Corr.	$3\ 40+$
<hr/>	
	$6\ 14\ 20$
Dip.	$3\ 49-$
<hr/>	
	$6\ 10\ 31$
Semid.	$16\ 16+$
<hr/>	
A. A.	$6\ 26\ 47$
Refr. and Par.	$7\ 54-$
<hr/>	
T. A. + 90°	$96\ 18\ 53$
Decl.	$20\ 19\ 15\ S.$
<hr/>	
Lat.	$75\ 59\ 38\ S.$

(2.)	
Decl. of α Urs. Maj.	$62^\circ 38' 23''\ N.$
Obs. Alt.	$10\ 46\ 50$
Ind. Corr.	$1\ 15-$
<hr/>	
	$10\ 45\ 35$
Dip.	$3\ 56-$
<hr/>	
A. A.	$10\ 41\ 39$
Refr.	$4\ 59-$
<hr/>	
T. A. + 90°	$100\ 36\ 40$
Decl.	$62\ 38\ 23\ N.$
<hr/>	
Lat.	$37\ 58\ 17\ N.$

Latitude from Altitude of a Heavenly Body in Bearing near the Meridian and Ship Mean Time.

(214.) The altitude of a heavenly body may frequently be observed at sea, when it is in bearing near the meridian, that is, when it bears nearly N. or S.; although it may not be possible, on the same day, to get the meridian altitude of the body. In such a case, if ship mean time be known nearly at the instant of the observation, the latitude may still be computed with sufficient accuracy for the purpose of navigating the ship safely.* To

* At a bearing of one point from N. or S. an error of one minute of time in the hour angle will produce no greater error in the computed lat. than $2'$ or $3'$. (See App. 17.)

find ship mean time nearly, the time by chronometer or by a good pocket watch may be noted when the altitude is observed; then proceed as follows.

(215.) *When time is taken by a chronometer whose error is supposed known on Gr. M. T.* Apply the supposed error, and thus get Gr. M. T. When the longitude is *east*, add it in time (note Art. 185) to Gr. M. T., rejecting 24^h if the sum be greater than 24^h , and putting the day one forward. When the longitude is *west*, subtract it in time from the Gr. M. T., first adding 24^h if necessary to Gr. M. T. and putting the day one back. The result will be ship M. T. (See *Ex. 1.*)

(216.) *When time is taken by chronometer or by a common watch, whose error is supposed known on Sh. M. T.* Apply the supposed error, and thus get Sh. M. T., from which the Gr. date may be got as in Art. 185.

(217.) For the Gr. date take from the Nautical Almanac: *For the sun*: its decl., semidiameter, and the equation of time. *For any other heavenly body*: its R. A. and decl., and the R. A. of the mean sun: *if it be the moon*, also its semidiameter and the hor. par.

(218.) From the observed altitude deduce the true zenith distance (Z. D.) as in Art. 211. Find the hour angle as in Arts. 199, 200. Then proceed by one of the following rules.

(219.) **RULE 1.** To the log. *havers.* of hour angle add the log. *cos.* decl. and mark the sum (*a*). To (*a*) add the log. *cos.* lat. by account, rejecting the tens in the index of sum. Find the arc in *degrees* corresponding to the result as a log. *havers.* Then take out the *nat. versine* corresponding to this arc, and subtract it from the *nat. versine* of the true zenith distance (Z. D.). The result will be the *nat. versine* of the meridian zenith distance (M. Z.), which take from the table of *nat. versines*, and mark it N. or S., according as the zenith is to the north or south of the body. Under it so marked put the declination with its proper sign N. or S. When the names are *like*, the *sum*, with the name of either, will be the *first computed latitude*; when the names are *unlike*, the *difference*, with the name of the *greater*, will be the *first computed latitude*.

If the *first* computed latitude differ considerably from the latitude by account, repeat the operation, by adding the log. *cos.* of first computed latitude to (*a*), and going through the rest as before. Thus get a *second computed latitude*, from which, if necessary, a third may be derived, and so on, till the two last computed latitudes do not differ essentially. (See *App. 17.*)

(220.) **RULE 2.** Add together log. *havers.* of hour angle, log. *cos.* decl., and 6.301030, and mark the sum (*b*). To (*b*) add log. *cos.* lat. by account, rejecting the tens in the sum of indices. Find the *nat. number** corresponding to the resulting logarithms, and subtract it from the *nat. versine* of the true zenith distance (Z. D.). The remainder will be the *nat. versine* of the meridian zenith distance (M. Z.); from which, and the declination, find the *first computed lat.* as above in Rule 1. If the first

* If this rule be used, care must be taken to write down one more integral figure in the *nat. number* taken from the tables than the index in the logarithm expresses. For instance, if the index be 0, one integral figure must be written down under or over the last figure of the *nat. versine* of Z. D.: if it be 1, two figures under or over the last two figures of the said *nat. versine*; and so on.

computed lat. *differ* considerably from the lat. by account, repeat the work, by adding the log. *cos.* of first computed lat. to (b), and going through the rest as before. Thus get a *second computed lat.*, and if necessary a *third*, till the last agrees sufficiently with the preceding one. (See *App.* 17.)

Ex. 1. Nov. 5, 1834, P.M., at 7^h 14^m 20^s, by a chronometer which was *fast* on Gr. M. T. 1^m 20^s, in latitude by account 51° N., and longitude by account 105° 15' W., the observed altitude of the sun's L. L. was 24° 45' 30", bearing at the same time nearly S., and having the zenith to the N. The index correction was -2' 10", and the height of the eye above the sea was 14 feet : required the true latitude.

Sun's decl. on Nov. 5, at Greenwich mean noon, 15° 38' 30" S.; on Nov. 6, 15° 56' 42" S.; corresponding Eq. T. 16^m 14^s.4 S., and 16^m 12^s.1 S.

Gr. Nov. 5, 7^h 13^m; sun's decl. 15° 43' 58" S.; semid. 16' 10" S.; Eq. T. 16^m 13^s.7 S.; Tr. Z. D. 65° 6' 7". Hour angle 0^h 28^m. 13^s.7.

First operation.

By RULE 1. . . 7.578504
9.983416

Second operation.

Third operation.

(a)	. . . . .	7.561920	. . . . .	7.561920	. . . . .	7.561920
		9.798872		9.816256		9.816361
		<hr/>		<hr/>		<hr/>
		7.360792		7.378176		7.378281
		5° 29' 31"		5° 36' 11"		5° 36' 10".6
<i>Nat. vers.</i>	. . .	0004590		0004778		0004778
		0578990		0578990		0578990
		<hr/>		<hr/>		<hr/>
		0574400		.0574212		0574212
M. Z.	. . .	64° 48' 41" N.		64° 47' 58" N.		64° 47' 58" N.
		15 43 58 S.		15 43 58 S.		15 43 58 S.
		<hr/>		<hr/>		<hr/>
Lat.	. . .	49 4 43 N.		49 4 0 N.		49 4 0 N.

First operation.

By RULE 2. 7.578504
9.983416
6.301030

Second operation.

Third operation.

(b)	. . . . .	23.862950	. . . . .	23.862950	. . . . .	23.862950
		9.798872		9.816256		9.816361
		<hr/>		<hr/>		<hr/>
		3.661822		3.679206		3.679311
<i>Nat. N.</i>	. . .	4590		4778		4778.8
		0578990		0578990		0578990
		<hr/>		<hr/>		<hr/>
		0574400		0574212		0574211.2
M. Z.	. . .	64° 48' 41"		64° 47' 58" N.		64° 47' 57".6 N.
Decl.	. . .	15 43 58		15 43 58 S.		15 43 58 S.
		<hr/>		<hr/>		<hr/>
Lat.	. . .	49 3 43 N.		49 4 0 N.		49 3 59.6 N.

Ex. 2. Oct. 23, 1834, P.M., at $4^h 50^m 0^s$, by chronometer which was *slow* on ship mean time $9^m 6^s$ nearly, in lat. by account 49° N., and long. by account $80^\circ 25'$ E., the obs. alt. of α Aquila (Altair) was $48^\circ 2' 20''$; the bearing being nearly S., and the zenith being N. of star. The index corr. was $+1' 40''$, and the height of the eye above the sea was 16 feet: required the true latitude.

R. A. mean sun, Oct. 22, at Gr. mean noon, $14^h 1^m 44^s.66$; on Oct. 23, $14^h 5^m 41^s.21$; R. A. α Aquila $19^h 42^m 42^s.3$; decl. α Aquila $8^\circ 26' 20''$ N.

Gr. Oct. 22, $23^h 37^m 26^s$. R. A. mean sun $14^h 5^m 37^s.6$. Tr. Z. D. $42^\circ 0' 58''$. Hour angle $23^h 22^m 1^s$ W., or $0^h 37^m 59^s$ E.

First operation.

By RULE 1. 7.835766
 9.995274

Second operation.

Third operation.

(a)	17.831040	17.831040	17.831040
	9.816943	9.810912	9.810064
	<hr/>	<hr/>	<hr/>
	7.647983	7.641952	7.641104
	$7^\circ 38' 48''$	$7^\circ 35' 37''$	$7^\circ 35' 10''$
Nat. vers. .	0008893	0008769	0008752
	0257011	0257011	0257011
	<hr/>	<hr/>	<hr/>
	0248118	0248242	0248259
M. Z. . . .	$41^\circ 14' 47''$ N.	$41^\circ 15' 26''$ N.	$41^\circ 15' 31''$ N.
Decl. . . .	$8^\circ 26' 20''$	$8^\circ 26' 20''$ N.	$8^\circ 26' 20''$ N.
	<hr/>	<hr/>	<hr/>
Lat. . . .	$49^\circ 41' 7''$	$49^\circ 41' 46''$ N.	$49^\circ 41' 51''$ N.

(221.) The above method of finding the latitude from altitudes observed near the meridian in bearing has been supposed to be applied at sea. An erroneous latitude by account may often be thus corrected, and the true latitude ascertained with sufficient accuracy for the purpose of navigating the ship so far in security. *On shore*, the error of a chronometer on mean time at the place may be frequently ascertained correctly, either by equal altitudes (see Art. 258), or even by single altitudes sufficiently far from the meridian (see Art. 253). From the chronometer therefore (by applying this error corrected by rate if necessary) mean time at the place may be accurately found, when an altitude is observed near the meridian; and since the mean time of the mer. passage is known, as in Arts. 203, 204, the difference of the two will be the *hour angle* measured in M. T., which, supposing the said angle to be small, will *for the sun* be the hour angle in time with sufficient accuracy. *For a fixed star*, the hour angle measured in M. T. must be increased by the seconds corresponding thereto taken from Naut. Table p. 12* (o) 1; and *for the moon or planet* it may be corrected as in Arts. 230, 231.

By proceeding thus, the result of a single altitude near the meridian in bearing will be at least as exact as that got from the mer. altitude. And, since a considerable number of such altitudes may be often got, even on both sides of the meridian, it appears that as great accuracy may be

expected in the mean result of the whole as the instrument used is capable of giving. The altitudes are commonly observed by means of an artificial horizon (see Art. 212), the corresponding times by chronometer being noted. The observations, if numerous, are divided into sets, each set not taking up more than 2 or 3 minutes of time. A mean of the times and a mean of the readings off are then taken for each set. The mean of the readings off is corrected for index correction, and then divided by 2, and the Tr. Z. D. found as in Art. 211. From the mean of the times the M. T. and hour angle are found as explained above.

Ex. June 27, 1834, A.M., in lat. by account $50^{\circ} 56' 15''$ N. and long. by account 3° W., the observations below were made by means of an artificial horizon. The index corr. was $+1' 1''$; the error of the chronometer on M. T. at the place was $8^m 26^s.2$ slow. The zenith was N. of the sun. The bar^r. stood at 29, and the ther^r. at 70: required the correct latitude.

Suns decl., June 27, at Gr. mean noon, $23^{\circ} 21' 19''.5$ N.; June 28, $23^{\circ} 18' 50''.3$ N., corresponding Eq. T., $2^m 31^s.72$ A., and $2^m 44^s 10$ A.; sun's semid. $15' 45''.2$.

Chronometer.	Readings off.	First Operation. RULE 2.	
$\begin{array}{r} h \quad m \quad s \\ 11 \quad 46 \quad 15.5 \\ 11 \quad 48 \quad 10.0 \\ 11 \quad 49 \quad 7.5 \end{array}$	$\begin{array}{r} 124 \quad 16 \quad 55 \\ 124 \quad 19 \quad 10 \\ 124 \quad 19 \quad 47 \end{array}$	$\begin{array}{r} 6.268072 \\ 9.962877 \\ 6.301030 \end{array}$	
			Second Operation.
Mean . . . $\begin{array}{r} 11 \quad 47 \quad 51 \\ 8 \quad 26.2+ \end{array}$	$\begin{array}{r} 124 \quad 18 \quad 37.3 \\ 1 \quad 1+ \end{array}$	$\begin{array}{r} (a) \quad 22.531979 \\ 9.799456 \end{array}$	$\begin{array}{r} 22.531979 \\ 9.799717 \end{array}$
Sh. June 26, $23 \quad 56 \quad 17.2$ M.T.	2) $124 \quad 19 \quad 38.3$	$\begin{array}{r} 2.331435 \\ 214 \end{array}$	$\begin{array}{r} 2.331696 \\ 214.5 \end{array}$
Long. . . . $12 \quad 0 \quad W.$	$\begin{array}{r} 62 \quad 9 \quad 49.1 \\ 15 \quad 45.1+ \end{array}$	$\begin{array}{r} 0113639 \\ 0113425 \end{array}$	$\begin{array}{r} 0113639 \\ 0113424.5 \end{array}$
Gr. June 27, $0 \quad 8 \quad 17.2$	Semid. $15 \quad 45.1+$		
Decl. . . . $23 \quad 21 \quad 18.7$	$\begin{array}{r} 62 \quad 25 \quad 34.2 \\ 24.2- \end{array}$	$\begin{array}{r} M.Z. \quad 27 \quad 33 \quad 15 \text{ N.} \\ Decl. \quad 23 \quad 21 \quad 18.7 \text{ N.} \end{array}$	$\begin{array}{r} 27 \quad 33 \quad 14.5 \text{ N} \\ 23 \quad 21 \quad 18.7 \text{ N} \end{array}$
Eq. T. . . . $\begin{array}{r} m \quad s \\ 2 \quad 31.79 \text{ A.} \end{array}$	Refr. par. $24.2-$		
(Art. 204) . $\begin{array}{r} 24 \quad 2 \quad 31.79 \\ 23 \quad 56 \quad 17.2 \end{array}$	$\begin{array}{r} W. A. \quad 62 \quad 25 \quad 10 \\ Z. D. \quad 27 \quad 34 \quad 50 \end{array}$	$\begin{array}{r} Lat. \quad 50 \quad 54 \quad 33.7 \end{array}$	$\begin{array}{r} 50 \quad 54 \quad 33.2 \text{ N} \end{array}$
Hour Angle $0 \quad 6 \quad 14.59$			

Latitude by Altitudes of Bodies in Bearing near the Meridian under the Pole. (See App. 18.)

(222.) Proceed as in Art. 215, &c., with the following alterations:—

1. For *hour angle* use the difference between hour angle and 12^h .
2. Instead of subtracting T. A. from 90° , add it to 90° , and use the sum as the Z. D. is used in rules Arts. 219 and 220.

The result of the computation will then be the true meridian altitude (M. A.) $+90^{\circ}$. From this subtract the *declination* of the body, and the remainder will be the latitude of the *same name* with the declination. (See App. 15.)

Ex. 1. On Dec. 12, 1834, at $0^h 28^m$, A.M., ship M. T. nearly, in lat. by acct. $70^{\circ} 20'$ S., and long. by acct. $76^{\circ} 30'$ W., the observed altitude of the sun's L. L. was $3^{\circ} 0' 15''$, being at the time in bearing near the inferior

mer. passage. The index correction was $+3' 10''$, and the height of the eye above the sea was 17 feet: required the true latitude.

Sun's decl., on Dec. 11, at Gr. mean noon, $23^{\circ} 0' 30''$ S.; on Dec. 12, $23^{\circ} 5' 17''$ S.; corresp^s. Eq. T. $6^m 34^s.17$ S. (see note Art. 190) and $6^m 6^s.29$ S.; sun's semid. $16' 16''$.

Gr., Dec. 11, $17^h 34^m$, sun's decl. $23^{\circ} 4' 0''$ S.; semid. $16' 16''$, Eq. T. $6^m 13^s.7$ S., T. A. $+90^{\circ}$ is $93^{\circ} 1' 56''$. Difference between the hour angle and 12^h is $0^h 34^m 13^s.7$.

First operation.

By RULE 1. 7.745525
 9.963811

Second operation.

Third operation.

(a).	17.709336	. . . . .	17.709336	. . . . .	17.709336
	9.527046		9.538880		9.538978
	<hr/>		<hr/>		<hr/>
	7.636382		7.248216		7.248314
	$4^{\circ} 45' 30''$		$4^{\circ} 49' 26''$		$4^{\circ} 49' 28''$
Nat. vers. .	0003446		0003541		0003543
	1052887		1052887		1052887
	<hr/>		<hr/>		<hr/>
	1049441		1049346		1049344
M.A. $+90^{\circ}$.	$92^{\circ} 50' 2''$		$92^{\circ} 49' 43''$		$92^{\circ} 49' 42''$
Decl. . . .	$23 \quad 4 \quad 0 \text{ S.}$		$23 \quad 4 \quad 0 \text{ S.}$		$23 \quad 4 \quad 0 \text{ S.}$

Lat. $69 \quad 46 \quad 2$ $69 \quad 45 \quad 43 \text{ S.}$ $69 \quad 45 \quad 42 \text{ S.}$

Ex. 2. Oct. 20, 1834, at $8^h 15^m$, P.M., ship mean time nearly, in lat. by acct. $50^{\circ} 30' \text{ N.}$, and long. by acct. $47^{\circ} 15' \text{ E.}$, the obs. alt. of α Urs. Maj. (*Dubhe*) was $22^{\circ} 50' 15''$, bearing nearly N. The index corr. was $+1' 20''$, and the height of the eye above the sea was 15 feet: required the true latitude.

R. A. mean sun, Oct. 20, at Gr. mean noon, $13^h 53^m 51^s.55$; on Oct. 21, $13^h 51^m 48^s.11$. R. A. α Urs. Maj. $10^h 53^m 25^s$; decl. $62^{\circ} 38' 28'' \text{ N.}$

Gr., Oct. 20, $5^h 6^m$. R. A. mean sun $13^h 54^m 42^s$. Difference between hour angle and 12^h is $0^h 43^m 43^s$. T. A. $+90^{\circ}$ is $112^{\circ} 45' 28''$.

First operation.

By RULE 2. 7.957552
 9.662337
 6.301030

Second operation.

Third operation.

(b)	23.920919	. . . . .	23.920919	. . . . .	23.920919
	9.803510		9.809980		9.810022
	<hr/>		<hr/>		<hr/>
	3.724429		3.730899		3.730941
Nat. N ^r .	0005302		0005382		0005382
	1386836		1386836		1386836
	<hr/>		<hr/>		<hr/>
	1381534		1381454		1381454
M. A. $+90^{\circ}$.	$112^{\circ} 25' 43''$		$112^{\circ} 25' 26''$		$112^{\circ} 25' 26''$
Decl. . . .	$62 \quad 38 \quad 28 \text{ N.}$		$62 \quad 38 \quad 28 \text{ N.}$		$62 \quad 38 \quad 28 \text{ N.}$
Lat.	$49 \quad 47 \quad 15 \text{ N.}$		$49 \quad 46 \quad 58 \text{ N.}$		$49 \quad 46 \quad 58 \text{ N.}$

Latitude by Altitude of Pole Star. (See App. 19.)

(223.) In accessible north latitudes the bearing of α Urs. Min. (Polaris), which lies within 2° of the north pole, is always very small, and its motion in altitude so slow, that an error of three or four minutes in the hour angle is of no consequence, when the latitude is to be determined only in an approximate degree. The mode of computation given in Arts. 214, 215, &c. might be used, if an easier one were not sufficiently accurate. The correction to be applied to the true altitude, in order to get the true altitude of the pole or the latitude of the ship, is computed for different latitudes and different years, and inserted in a table (see Nautical Tables, p. 10), from which it may be taken by inspection. The mode of observing the altitude of this star with the sextant is as follows. Bring the index nearly to 0 on the arc, holding the instrument in a plane passing through the star and the north point of the horizon; and direct the view to the star through the transparent part of the fixed reflector. Move the index slowly by hand and watch in the quicksilvered part for the motion of the image of the star, which then bring down and follow slowly to the horizon; taking care not to lose sight of the image till a contact is made with the nearest point of the horizon. The rule for the necessary computation is as follows.

(224.) RULE. Get a Gr. date as in Art. 185, or as in note thereto. For this date take from the Nautical Almanac the R. A. of mean sun (which may be done by inspection). To *ship mean time* expressed astronomically add *R. A. of mean sun*, rejecting 24^h from the sum if greater than 24^h , the result will be the *meridian R. A.*; correct the observed altitude for index correction, dip, and refraction (see Art. 211), and thus get the true altitude (T. A.). Enter the table of correction for Pole Star with the *meridian R. A.* and at the top with the nearest latitude to that by account. The correction being taken out and applied with its proper sign to the T. A., the result will be the required latitude. (See App. 19.)

Ex. 1. April 14, 1835, at $2^h 30^m$, A.M., mean time nearly, in latitude by account 66° N. and longitude by account $150^\circ 15'$ E., the observed altitude of α Urs. Min. (Polaris) was $65^\circ 10' 40''$; the index correction was $+2' 50''$, and the height of the eye above the sea was 15 feet: required the true latitude. R. A. mean sun on April 13, at Gr. mean noon $1^h 23^m 48^s.78$, on April 14, $1^h 27^m 45^s.34$.

Ex. 2. Oct. 15, 1835, at $10^h 25^m$, P.M., mean time nearly, in latitude by account $49^\circ 30'$ N. and longitude $55^\circ 12'$ W., the observed altitude of α Urs. Min. (Polaris) was $50^\circ 47' 15''$; the index correction was $-3' 10''$, and the height of the eye above the sea was 18 feet: required the true latitude. R. A. mean sun on Oct. 15 at Gr. mean noon $13^h 33^m 11^s.62$, on Oct. 16, $13^h 37^m 8^s.18$.

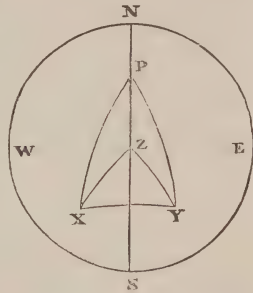
(1)				(2)			
Sh. April 13 . .	$14^h 30^m$			Sh. Oct. 15 . .	$10 25 M.$	$50^\circ 47' 15''$	
Long. in T. . .	$10 1 E.$	Incorr.	$2 50 +$	Long. in T. . .	$3 41 W.$	$3 10 -$	
Gr. April 13 . .	$4 29$			Gr. Oct. 15 . .	$14 6$	$50 44 5$	
		Dip.	$3 49 -$	R. A. M. sun . .	$13 35\frac{1}{2}$	$4 11 -$	
	$h m s$			Sh. M. T. . .	$10 25$		
R. A. M. sun . .	$1 24 33$		$65 9 41$			$50 39 54$	
Sh. mean time	$14 30 0$	Refr.	$27 -$	Mer. R. A. . .	$0 0\frac{1}{2}$	$48 -$	
Mer. R. A. . .	$15 54 33$		$65 9 14$			$50 39 6$	
		Tab. corr.	$1 9 20$			$corr. 1 30 43 -$	
			Lat. $66 18 34 N.$				Lat. $49 8 23 N$

When the altitude of Polaris can be taken correctly, and mean time at the ship is known also correctly, the latitude may be found with great accuracy, as in Art. 221.

Latitude from two Altitudes of the same, or different Heavenly Bodies, off the Meridian.

(225.) One of the most important methods of determining the latitude at sea, is by taking with Hadley's Sextant two altitudes of the same or different heavenly bodies off the meridian, under certain limitations in bearing; the interval between the observations, if there be any, being measured by a chronometer or watch.

Let NWSE be the rational horizon, NS the meridian, Z the zenith, and P the pole of the heavens. Let X and Y be the same or different heavenly bodies; ZX, ZY, PX, PY, XY, arcs of great circles. Then PZ is the colatitude of the place, PX and PY are respectively the polar distances of X and Y, ZX and ZY their zenith distances, ZPX, ZPY their hour angles, SZX, SZY their true bearings from the S. Now in this figure we know by observation ZX and ZY, and from the Naut. Almanac PX and PY; also by means of the elapsed time as measured by a chronometer, or from the right ascensions of the bodies, or from both, we know the *polar angle* XPY. Hence the arc PZ, and consequently what it wants of 90° , or the latitude, may be found.



For in the triangle PXY we know PX, PY, and the included angle XPY, from which XY may be found. Then in each of the triangles PXY, ZXY, we know three sides; whence may be computed the angles PXY and ZXY, from which we deduce the angle PXZ, their difference or sum. Lastly, in the triangle PXZ, knowing the two sides ZX, PX, and the included angle PXZ, we can determine PZ the colatitude, and thence the latitude. (See App. 21.)

(226.) *Limits to be attended in the Two Bearings.* (See App. 23.)

(1.) *Both observations E. or both W. of meridian.* The difference of the two bearings (or change of bearing) should exceed the less bearing.

(2.) *One observation E. and the other W. of meridian.* The limit just given in (1) will hold good, if for the greater bearing be substituted the bearing opposite thereto, as NE. for SW.

(3.) By the *less bearing* is to be understood the less of the two, whether they are reckoned from the N. or S.

(4.) When the bearings on different sides of the meridian are equal, either may be considered as the *less*.

(227.) The seaman may in most cases determine with sufficient accuracy by the eye, when the two bearings fall within the above limits.

Should a compass be used for this purpose, the variation (Art. 31) should be applied so as to get the true bearings.

The nearest arc on the celestial concave drawn between the places of the body or bodies should not pass (if necessary when produced) near the zenith or celestial pole*, but *distinctly* on the same side of both, or distinctly between them. This arc may be traced by the eye.

Finding Polar Distances.

(228.) From the chronometer, or from ship mean time nearly, and the longitude, get a Greenwich date as in Art. 185, or as in note thereto, for each observation. For this date take from the Nautical Almanac the declination (see Arts. 185, &c.). When the latitude by account and declination have the *same* names, *subtract* the declination from 90° , the result will be the polar distance (P. D.). When the declination and latitude by account have *different* names, *add* 90° to the declination: the result will be the polar distance (P.D.).

For a fixed star no Greenwich date need be found as above; the declination taken out for the day will be sufficiently correct.

Finding Polar Angle.

(229.) *For two altitudes of the Sun.* Note the time shewn by a chronometer or good pocket watch at each observation, and thence get the amount of the interval between the observations, or the time elapsed. Correct this for the amount of any known rate, adding if *losing*, and subtracting if *gaining*. Correct then in strictness for any variation of the equation of time in the interval; *adding* if the equation of time be additive to app. time and decreasing, or subtractive from app. time and increasing; otherwise *subtracting*: the result will be the polar angle in time.

(230.) *For two altitudes of the Moon.* Get the time elapsed by the chronometer or watch, and correct it for rate. Find the difference between the increase of the moon's right ascension† and that of the right ascension of mean sun, and subtract this difference: the result will be the polar angle.

(231.) *For two altitudes of a Planet.* As for the moon; taking care to *add* the difference of increase in right ascension for the planet and mean sun, when that for the mean sun is the *greater*; and to *subtract* this difference when that for the mean sun is the *less*.

(232.) *For two altitudes of the same fixed Star.* Get the time elapsed by a watch or chronometer and correct it for rate. Add to the correct time elapsed the increase of the right ascension of the mean sun in the interval (see note): the result will be the polar angle in time.

(233.) *For two altitudes of different bodies observed at the same instant.* Get a Greenwich date as in Art. 185, or as in note thereto. For

* The celestial pole is at an altitude equal to the latitude above the N. or S. point of the horizon, according as the latitude is N. or S.

† This increase may be supposed to commence at the hour of the first Greenwich date, and to be proportioned for the interval. The increase of R. A. of mean sun may be taken for the interval by a table. (See Naut. Tables, p. 12* (o) 1.)

this date take from the Nautical Almanac the right ascensions of the bodies. Their difference, or (if greater than 12^h) what it wants of 24 hours, will be the polar angle in time.

(234.) *For two altitudes of different bodies observed at different times.* Get the correct elapsed time by means of a watch or chronometer and its rate; and add thereto the increase of the right ascension of the mean sun in the interval *. Get a Greenwich date for each observation, and take out of the Nautical Almanac the right ascension of each body. To the right ascension of the body *first observed* add the corrected time elapsed. Take the difference between the sum and the right ascension of the body *last observed*, rejecting if necessary 24 hours. The result, or (if greater than 12^h) what it wants of 24 hours, will be the polar angle in time.

(235.) The correctness of the above rules for finding the polar angle will appear as follows.

When the sun is twice observed, the interval, as shewn by a watch going correctly according to *apparent* solar time, would be the angle described by the sun round the pole. The interval measured by a mean solar watch going regularly will therefore want correcting for the gain or loss of the latter watch on the former. This gain or loss will be the change of the equation of time in the interval applied as in the rule. It is evidently necessary also first to apply a correction for the rate of the watch.

(236.) When the moon is twice observed, the interval, as shewn by a watch adjusted to go with the moon, would be the polar angle. But a watch is supposed to go with the mean sun, and goes faster than a lunar watch: it shews more time in the interval of the observations than the latter by the excess of the moon's motion in right ascension (in time) over that of the mean sun; which last is at the rate of $3^m 56^s.6$ in 24 hours. A similar explanation applies to a planet.

(237.) When the same star is twice observed, the interval measured by a *sidereal* clock would be the angle at the pole described by the star. The same interval measured by a mean solar watch will be too little, since a mean solar watch goes more slowly than a sidereal clock by about 10 seconds in a hour, and 1 second in 6 minutes. The propriety of the correction pointed out in the rule is therefore manifest. When two bodies are observed at the same instant, the polar angle is evidently the difference of the right ascensions, or what that difference wants of 24 hours; the *log. havens*. of either will be the same. When two different bodies are observed, and there is an interval between the observations, in such a case the polar angle will be the difference between the right ascension of the place of the body last observed, and that of the place of the other on its circle of diurnal motion when its altitude was taken. This latter right ascension must manifestly be got by adding the interval in sidereal time to the right ascension of the body itself when observed; since, by the apparent diurnal motion of the celestial concave from east to west, the point it was at before must have been carried so much to the westward.

* See last note on preceding page.

Zenith Distances.

(238.) The observed altitudes are corrected as in Art. 211, and the true altitudes found. A correction is then applied to the T. A. first observed for the run of the ship in the interval of the observations, by the following rule: by which the said T. A. is reduced to what it would have been at the place of the second. Take each T. A. (after this correction of the first) from 90° , the results will be the zenith distances (Z. D.). When both the altitudes are taken at the same instant or nearly so, no correction of this kind is necessary.

Correction of First Altitude for Run of Ship, App. 20.

(239.) **RULE.** When the first altitude is taken, observe by means of the compass the bearing of the sun, and applying the variation, get its true bearing. Find by working the log. account the true course of the ship and distance run in the interval. Then with the distance run as a *dist.* and the angle between the true bearing of the sun at the first observation, and true course of the ship in the interval as a *course* (supposed less than 8 points), enter the Traverse Table and take out the *diff. lat.*, which add to the first true altitude. When the *course* so deduced is greater than 8 points, enter the Traverse Table with what it wants of 16 points, and subtract the *diff. lat.* taken out from the first true altitude.

When the *course* so deduced is 0, add the whole distance run; when it is 16 points subtract the whole distance run; when it is 8 points there is no correction.

The *tenths* of nautical miles or minutes in the Traverse Table may be turned into seconds by multiplying them by 6.

Having determined as above the polar distances, polar angle, and the zenith distances, arrange them under the heads of greater bearing and less bearing (see examples); and then compute the true latitude by the following rule.

(240.) RULE for Double Altitude, App. 21.

To find (1). Add together *log. sines* of both polar distances, and *log. havens.* of polar angle, rejecting the tens in the index of the sum. With result as a *log. havens.* take out the arc in degrees and mark it (*a*), see note.* To *nat. vers.* of (*a*) add *nat. vers.* of difference of polar distances. With sum as *nat. vers.* take out the arc, and mark it (1). See note*.

* When the *diff. pol. dist.* is *nothing*, as for the *same fixed star*, arc (*a*) itself is arc (1). When the *diff. pol. dist.* is small, as when the *sun* is observed at each time, or the *moon*, or a *planet*, to find arc (1) add the seconds (if they appear of any consequence) from the following Table to arc (*a*). Should the *diff. pol. dist.* be greater than $40'$, it will be best to proceed by general rule.

Arc (<i>a</i>)	90°	70°	60°	55°	50°	45°	40°	35°	30°	25°	20°	15°	10°	8°	6°	4°	2°
Diff. Pol. Dist.																	
10	1	1	1	1	1	1	1	1	2	2	2	3	5	6	8	12	24
20	4	4	4	4	4	5	5	6	7	8	10	13	20	25	34	51	97
30	8	8	9	9	10	11	12	14	16	18	23	30	45	57	75	111	222
40	14	15	16	17	18	20	22	24	28	33	41	54	80	101	134	200	399
Arc (<i>a</i>)	90°	110°	120°	125°	130°	135°	140°	145°	150°	155°	160°	165°	170°	172°	174°	176°	178°

To find (2). Under (1) put polar distance at greater bearing; take the difference, under which put polar distance at less bearing. Take the sum and difference. Add together *log. cosecants* (rejecting 10 from each index) of the two first terms in this form and the *halves** of *log. haversines* of the two last terms. With the sum as *log. havers.* take out the arc in degrees, and mark it (2).

To find (3) and (4). Again, under (1) put the zenith distance at the greater bearing; take the difference, under which put the zenith distance at the less bearing. Take the sum and difference. Add together *log. cosecants* (rejecting 10 from each index) of the two first terms in this form, and the *halves* of *log. haversines* of two last terms. With the sum as a *log. havers.* take out the arc in degrees, and mark it (3).

To find (b) if necessary †. Subtract the latitude by account from 90°, and under the remainder put the difference of the zenith and polar distances at the greater bearing. Take the sum and the difference. Add together the *second log. cosecants* as used in the two preceding forms, and the *halves* of *log. haversines* of the two last terms in the form. With the sum as a *log. havers.* take out the corresponding arc in degrees and call it (b).

Take the difference or the sum ‡ of (2) and (3), according as (b) is nearer to their difference or sum; and mark the result (4).

To find Latitude. Add together *log. sine* of polar distance at greater bearing, *log. sine* of zenith distance at greater bearing, and *log. havers.* of arc (4), rejecting the tens in the index of sum. With the result as a *log. havers.* take out the arc in degrees. To the *nat. vers.* of this arc add *nat. vers.* of difference of polar and zenith distance at greater bearing. The sum will be the *nat. vers.* of an arc, which take from the table and subtract from 90°: the result will be the required latitude.§

When near the equator the arc may be greater than 90°, in which case the excess above 90° will be the latitude required, of a different name from that of the lat. by account. (See *App.* 22.)

Ex. 1. April 2, 1834, the following altitudes of the sun, &c., were observed to determine the latitude.

Mean Time nearly.	Chronometer.	Obs. Alt. Sun's L. L.	Tr. Bearing.
6 ^h 30 ^m A.M.	1 ^h 29 ^m 50 ^s	9° 30' 10"	E. $\frac{1}{2}$ S.
2 0 P.M.	9 0 55	42 29 25	S. W. b. S.

The run of the ship in the interval was S.S.E. 18 miles; the index correction was $-1' 40''$, and the height of the eye above the sea was 15 feet: required the true latitude at the second observation; the latitude by account being 42° N. and longitude 74° 30' E. Rate of chronometer 18.2 seconds

* In taking out the *halves* of *log. haversines* the computer will find the easiest way is to divide by 2 by inspection, following the division with his left hand.

† In all cases whatever take the difference of (2) and (3) for (4), *unless* the distance arc between the places of the body or bodies passes between the zenith and pole (Art. 227), in which case *alone* take their sum. If the seaman can determine this distinctly by tracing the said distance arc with his eye, the computation of arc (b) may be omitted.

‡ If the sum of (2) and (3) be greater than 180°, the supplement to 360° must be considered as the sum.

§ *Log. sin.* pol. dist. at gr. bearing, and its *log. cosec.* may be taken out at the same opening; also *log. cosec.* zen. dist. at gr. bearing, and its *log. sin.* When arc, of which the *log. cosec.* is wanted is greater than 90°, take *log. sec.* of what it is above 90°. Thus for *log. cosec.* of 98° 10' look out *log. sec.* of 8° 10'

gaining. Sun's decl. on April 1 at Gr. mean noon $4^{\circ} 27' 59''$ N., on April 2, $4^{\circ} 51' 6''$ N., corresponding Eq. T. $4^m 1^s.06$ A, and $3^m 42^s.8$ A. (see note, Art. 190) semid. $16' 1''$.

The Greenwich dates are got from ship mean time nearly and the longitude as in Art. 185. For each of these dates the sun's decl. is taken from the Nautical Almanac as in Art. 186, also the semid. The declination having the same name (N) as the latitude by account, is taken from 90° for the polar distance in each case. The observed altitudes are corrected as in Art. 211, and the correction for the run of the ship to be applied to the first true altitude is $8' 30'' +$, this being the *diff. lat.* corresponding to a *dist.* 18 miles and a *course* $5\frac{1}{2}$ points between E. $\frac{1}{2}$ S. and S. S. E. The zenith distances are then got by subtracting from 90° . The interval by chronometer is $7^h 31^m 5^s$: to which the amount of rate (gaining) 5.7^s being subtracted, the true interval in mean time is $7^h 30^m 59^s.3$. In this interval the change of the equation of time is 5.7^s decreasing, the equation itself being *additive* to apparent time (see note, Art. 190): consequently 5.7^s must be added, which makes the polar angle in time described by the sun to be $7^h 31^m 5^s$.

At Greater Bearing. Pol. Dist. $85^{\circ} 18' 59''$. Zen. Dist. $80^{\circ} 16' 9''$.

At Less Bearing. Pol. Dist. $85^{\circ} 11' 45''$. Zen. Dist. $47^{\circ} 21' 0''$.

Polar Angle $7^h 31^m 5^s$ Diff. of Pol. Dist. $0^{\circ} 7' 14''$. Diff. of Zen. and Pol. Dist. at Greater Bearing $5^{\circ} 2' 50''$.

To find (1).	To find (2).	To find (3) and (4).	To find (b).	To find Lat.
9.998547	(1) $112^{\circ} 10' 52''$	$112^{\circ} 10' 52''$	$90^{\circ} 0' 0''$	9.998547
9.998471	85 18 59	80 16 9	42 0 0	9.993704
9.841061				9.204697
	26 51 53	31 54 43	48 0 0	
9.838079	85 11 45	47 21 0	5 2 50	9.196948
(a) $112^{\circ} 10' 52''$				$46^{\circ} 44' 40''$
	112 3 38	79 15 43	53 2 50	
	58 19 52	15 26 17	42 57 10	
No increase of consequence from diff. pol. dist. See Table, p.106. Consequently (a) may be considered as (1).	0.033392 0.001453 4.918723 4.687842 9.641411	0.033392 0.006294 4.804714 4.128125 8.972525	0.001453 0.036294 4.649875 4.563634 9.221256	0314746 0003869 0318615 $47^{\circ} 2' 53''$
	(2) $82^{\circ} 52' 15''$	(3) $35^{\circ} 40' 52''$ (2) 82 52 15	(b) $48^{\circ} 9' 15''$	Lat. $42^{\circ} 57' 7''$ N.
		(4) 47 11 23. See (b)		

Ex. 2. Nov. 6, 1834, the following altitudes, &c., of the moon were observed in order to find the latitude.

Mean Time nearly.	Chronometer.	Obs. Alt.	Tr. Bearing.
$4^h 45$ P.M.	$5^h 40^m 30^s$	$36^{\circ} 45' 10''$	S. S. W. $\frac{1}{2}$ W.
$9 28$ P.M.	$10 23 35$	$5 40 20$	S. W. by W. $\frac{1}{2}$ W.

The run of the ship in the interval was S. S. E. 10 miles; the index correction was $-3' 50''$, and the height of the eye above the sea was 17 feet: required the true latitude; the latitude by account being 27° N. and longitude $80^{\circ} 30'$ E. Daily rate of chronometer $13^s.5$ losing.

Moon's decl. on Nov. 5, at 23^h , $24^{\circ} 32' 36''$ S., at 24^h , $24^{\circ} 29' 34''$ S., on Nov. 6, at 4^h , $24^{\circ} 16' 1''$ S., at 5^h , $24^{\circ} 12' 17''$ S.; corresponding R. A.

moon $19^{\circ} 37^m 14''.3$; $19^{\circ} 39^m 39''.6$; $19^{\circ} 49^m 17''.4$; $19^{\circ} 51^m 41''.1$. Moon hor. semid. on Nov. 5, at Gr. mean midn. $15' 46''.8$, on Nov. 6, at Gr. mean noon $15' 39''.0$, on Nov. 6, at Gr. mean midn. $15' 31''.5$. Corresponding hor. par. $57' 54''.6$; $57' 26''$; $56' 58''.2$.

The Greenwich dates, the declinations, hor. semid., and hor. parallax of the moon are got as in Art. 185, and following Arts. The observed altitudes are corrected as in Art. 211. Then to the first true altitude (T. A.) is added $6' 42''$, the *diff. lat.* corresponding to 10 miles as a *dist.* and a *course* $4\frac{1}{2}$ points, the difference of bearing between S. S. W. $\frac{1}{2}$ W. and S. S. E. (See Art. 239.) The moon's declinations, which are both S., the latitude by account being N., are added to 90° for the polar distances. The true altitudes (the first corrected for the run of the ship) are subtracted from 90° for the zenith distances.

The interval by the chronometer is $4^h 43^m 5''$; correcting this for the amount of rate $2^s.1 +$, the correct interval in mean time is $4^h 43^m 7^s.1$. The increase of the moon's right ascension in this interval beginning Nov. 5, 23^h (the hour of the first Greenwich date) is $11^m 23''$; the corresponding increase of R.A. of mean sun is $46^s.5$: their difference is $10^m 36^s.5$, which being subtracted from the interval in mean time, the polar angle is got, namely, $4^h 42^m 30^s.6$.

At Greater Bearing. Pol. Dist. $114^{\circ} 15' 39''$. Zen. Dist. $83^{\circ} 23' 44''$.

At Less Bearing. Pol. Dist. $114^{\circ} 31' 26''$. Zen. Dist. $52^{\circ} 15' 33''$.

Polar Angle $4^h 32^m 30^s.6$. Diff. of Pol. Dist. $0^{\circ} 15' 47''$. Diff. of Zen. and Pol. Dist. at Gr. Bearing $30^{\circ} 51' 55''$.

To find (1).	To find (2).	To find (3) and (4).	To find (b).	To find Lat.
9.959839	$61^{\circ} 20' 33''$	$61^{\circ} 20' 33''$	$90^{\circ} 0' 0''$	9.959839
9.958936	*114 15 39	83 23 44	27 0 0	9.997109
9.496550				9.336503
	52 55 6	22 3 11	63 0 0	
9.415325	114 31 26	52 15 33	30 51 55	9.293451
(a) $61^{\circ} 20' 30''$				$52^{\circ} 38' 0''$
Tab. p. 106 3+	167 26 32	74 18 44	93 51 55	
	61 36 20	30 12 22	32 8 5	0393086
(1) 61 20 33				0141627
	0.056755	0.056755	0.040154	
	0.040154	0.002891	0.002891	0534713
	4.997387	4.781025	4.863655	$62^{\circ} 16' 16''$
	4.709359	4.415903	4.442096	
	9.803655	9.256574	9.348796	Lat. 27 43 44
(2) $105^{\circ} 49' 7''$	(3) $50^{\circ} 17' 15''$	(b) $56^{\circ} 23' 30''$		
	(2) 105 49 7			
	(4) 55 31 52	See (b).		

Ex. 3. Nov. 18, 1834, observed the following altitudes, &c., of the planet Mars to determine the latitude.

Mean Time nearly.	Chronometer.	Obs. Alt. of Cr. of Planet.	True Bearing.
$2^h 0^m$ A. M.	$3^h 10^m 40^s$	$54^{\circ} 40' 20''$	S. S. E.
7 15 A. M.	8 25 30	$32^{\circ} 50' 30''$	S. W.

* For *log. cosec.* of $114^{\circ} 15' 39''$, take out *log. sec.* $24^{\circ} 15' 39''$, see note §, page 107.

The run of the ship in the interval was North 10 miles: the index correction was $+0' 40''$, and the height of the eye above the sea was 14 feet: the latitude by account being 53° N. and longitude 18° W. The distance arc between the places of the planet evidently did *not* pass between the zenith and pole. Rate of chronometer $8^s.5$ *losing*.

Planet's decl. on Nov. 17, at Gr. mean noon $23^\circ 40' 26''$ N. on Nov. 18, $23^\circ 42' 22''$ N. Increase of planet's R. A. in 24^h is 22^s .

The Greenwich dates and declinations are found as in Art. 185, &c. The observed altitudes are corrected as in Art. 211; to the first T. A. the correction for the run of the ship $9' 12''$ —is applied, being the *diff. lat.* corresponding to the *dist.* 10 miles, and *course* 2 points, what the *diff.* of bearing between S.S.E. and North wants of 16 points: the results being taken each from 90° , give the zenith distances. The interval by chronometer is $5^h 14^m 50^s$, which being corrected for the rate by $1^s.8+$, the interval in mean time is $5^h 14^m 51^s.8$. The *diff.* of increase of planet's R. A. and mean sun's R. A. is $47^s.1+$, the latter being the greater. Hence Polar Angle is $5^h 15^m 39^s$.

At Greater Bearing. Pol. Dist. $66^\circ 17' 55''$. Zen. Dist. $50^\circ 13' 32''$.

At Less Bearing. Pol. Dist. $66^\circ 18' 21''$. Zen. Dist. $35^\circ 32' 28''$.

Polar Angle $5^h 15^m 39^s$. Diff. of Pol. Dist. $0^\circ 0' 26''$. Diff. of Zen. and Pol. Dist. at Greater Bearing $16^\circ 4' 23''$.

To find (1).	To find (2).	To find (3) and (4).	To find Lat.
9.961735	$71^\circ 10' 7''$	$71^\circ 10' 7''$	9.961735
9.961749	66 17 55	50 13 32	9.885679
9.606216			9.031587
	4 52 12	20 56 35	
9.529700	66 18 21	35 32 28	8.879001
(a) $71^\circ 10' 7''$			$31^\circ 56' 10''$
	71 10 33	56 29 3	0151361
	61 26 9	14 35 53	0039091
There being little diff.			
of pol. dist., (a) is also	0.023891	0.023891	0190452
(1). See note p. 106.	0.038268	0.114321	$35^\circ 56' 53''$
	4.764882	4.675004	
	4.708265	4.103959	Lat. 54 3 7 N.
	9.535306	8.917175	
	(2) $71^\circ 42' 0'$	(3) $33^\circ 24' 45''$	
		(2) 71 42 0	
		(4) 38 17 15.	See note †, p. 107.

Ex. 4. Feb. 28, 1834, the observed altitude of α Urs. Maj. was $41^\circ 12' 15''$ bearing N. 10° W., the index correction being $-0' 50''$; and at the same instant the observed altitude of α Scorpio was $14^\circ 17' 30''$ bearing S. 40° E., the index correction being $+2' 10''$; the height of the eye in each case above the sea was 18 feet: required the true latitude; the latitude by account being 15° N.

The distance arc between the two stars evidently passed between the zenith and pole. The declination of α Urs. Maj. $62^\circ 38' 43''$ N., R. A. $10^h 53^m 27^s$. Decl. of α Scorpio $26^\circ 3' 15''$ S., R. A. $16^h 19^m 14^s$.

At Greater Bearing. Pol. Dist. $116^{\circ} 5' 15''$. Zen. Dist. $75^{\circ} 48' 16''$.

At Less Bearing. Pol. Dist. $27^{\circ} 21' 17''$. Zen. Dist. $48^{\circ} 50' 52''$.

Polar Angle (see Art. 233) $5^{\text{h}} 25^{\text{m}} 47^{\text{s}}$. Diff. of Pol. Dist. $80^{\circ} 41' 58''$.
Diff. Zen. and Pol. Dist. at Greater Bearing $40^{\circ} 14' 59''$.

To find (1).	To find (2).	To find (3) and (4).	To find (b).	To find Lat.
9.953460	$109^{\circ} 11' 24''$	$109^{\circ} 11' 24''$	$90^{\circ} 0' 0''$	9.953460
9.662275	116 3 15	75 48 16	15 0 0	9.986531
9.629030				9.460185
	6 51 51	33 23 8	75 0 0	
9.244765	27 21 17	48 50 52	40 14 59	9.400176
(a) $49^{\circ} 33' 50''$				$60^{\circ} 10' 14''$
0351400	34 13 8	82 14 0	115 14 59	0502580
0977303	20 29 26	15 27 44	34 45 1	0236765
1328703	0.024833	0.024833	0.046540	0739345
(1) $109^{\circ} 11' 24''$	0.046540	0.013469	0.013469	$74^{\circ} 53' 28''$
	4.468637	4.817958	4.926631	
	4.250107	4.128801	4.475125	Lat 15 6 32 N.
	8.790117	8.985061	9.461765	
(2) 28 45 34		(3) $36^{\circ} 13' 8''$	(b) $65^{\circ} 6' 45''$	
		(2) 28 45 34		

(4) $64^{\circ} 58' 42''$ See *b* and note †, p. 107.

Ex. 5. Nov 4, 1834, the following altitudes, &c., were observed to determine the latitude.

Mean Time nearly.	Chronometer.		Obs. Alt.	True Bearing.
$6^{\text{h}} 30^{\text{m}}$ P. M.	$6^{\text{h}} 20^{\text{m}} 15^{\text{s}}$	α Serpens	$16^{\circ} 40' 10''$	W. b. S.
7 30 P. M.	7 21 45	α Aquila	45 15 20	S. S. W.

The run of the ship in the interval was S. S. E. $6\frac{1}{2}$ miles; the index correction was $+1' 50''$, and the height of the eye above the sea was 15 feet: required the true latitude, the latitude by account being $47^{\circ} 20' \text{ N.}$ and longitude $52^{\circ} 30' \text{ E.}$ The rate of the chronometer was 6 seconds losing.

Decl. of α Serpens $6^{\circ} 57' 12'' \text{ N.}$; R. A. $15^{\text{h}} 36^{\text{m}} 6^{\text{s}}$. Decl. α Aquila $8^{\circ} 26' 19'' \text{ N.}$, R. A. $19^{\text{h}} 42^{\text{m}} 42^{\text{s}}$.

The polar distance and zenith distances are found as in the preceding examples. The interval by chronometer is $1^{\text{h}} 1^{\text{m}} 30^{\text{s}}$. This being corrected for rate $+0.3$ seconds, the interval in mean time is $1^{\text{h}} 1^{\text{m}} 30^{\text{s}}.3$. This being corrected for the amount of increase of R. A. of m. sun , namely $+10$ sec., the interval in sidereal time is $1^{\text{h}} 1^{\text{m}} 40^{\text{s}}.3$. Adding this to the R. A. of α Serpens (the first observed star) and taking the difference (see Art. 234) between the result and the R. A. of α Aquila, the polar angle is thus found to be $3^{\text{h}} 4^{\text{m}} 56^{\text{s}}$.

At Greater Bearing. Pol. Dist. $83^{\circ} 2' 48''$. Zen. Dist. $73^{\circ} 26' 19''$.

At Less Bearing. Pol. Dist. $81^{\circ} 33' 41''$. Zen. Dist. $44^{\circ} 47' 36''$.

Polar Angle $3^{\text{h}} 4^{\text{m}} 56^{\text{s}}$. Diff. of Pol. Dist. $1^{\circ} 29' 7''$ Diff. of Zen. and Pol. Dist. at Greater Bearing $9^{\circ} 36' 29''$.

To find (1).	To find (2).	To find (3) and (4).	To find (b).	To find Lat.
9.996793	45° 48' 57"	45° 48' 57"	90° 0' 0"	9.996793
9.995274	83 2 48	73 26 19	47 20 0	9.981596
9.187911				9.128071
	37 13 51	27 37 22	42 40 0	
9.179978	81 33 41	44 47 36	9 36 29	9.106460
(a) 45° 27' 20"				
0302695	118 47 32	72 24 58	52 16 29	41° 53' 20"
0000336	44 19 50	17 10 14	33 3 31	
				0255559
0303031	0.144412	0.144412	0.003207	0014027
(1) 45° 48' 57"	0.003207	0.018404	0.018404	
	4.934854	4.771384	4.643972	0269586
	4.576660	4.174006	4.454087	43° 4' 44"
	9.659133	9.108206	9.119670	Lat. 46 55 16 N.
(2) 84° 58' 20"	(3) 41° 58' 37"	(b) 42° 33' 45"		
	(2) 84 58 20			
	(4) 42 59 43			

Remarks.

(241.) The above method of finding the latitude from two altitudes of the same or different heavenly bodies off the meridian will become easy by a little attention and practice; at the same time it has the advantage of being direct and general. The methods of making the computation by correcting the estimated latitude of the ship, and approximating to the true latitude by repeated operations, are omitted as greatly inferior to the rule given above. Several attempts have been made to improve these methods of approximation, but it does not appear possible to render any one of them practically easy, and applicable in all cases, where the latitude may be determined by observations of this kind.

In concluding this subject, it may be proper to make one or two additional remarks thereon for the guidance of the seaman.

(242.) In the first place, the watch, with which the times are taken, should show an interval of three or four hours, without the probability of making an error of more than five or six seconds; and the sextant or quadrant made use of should be one, the accuracy of which may be depended on within 1 or 2 minutes. To diminish the errors of observation, two or three altitudes should be taken each time, and a mean of them and of the corresponding times by the watch should be used in the calculation.

(243.) In fixing the limits, the error to which an observer is liable, in taking the altitude of a heavenly body at sea, has been supposed to be about 2 minutes; so that the error in latitude on this account would never be more than 5 or 6 minutes, and generally not more than 2 or 3 minutes.

Perhaps, in taking the altitude of a star or planet, a much greater error than this may be made, especially when the horizon is imperfectly seen. In such cases the limits must be something modified by increasing the difference between the bearings (see Art. 226 (1), (2), &c.) with respect to the less bearing.

The seaman, however, will be the best judge, by a little practice, what degree of accuracy in the resulting latitude he may expect from double alti-

tudes of fixed stars or planets, particularly if he make trial of these observations, under different circumstances, when he knows the true latitude from other sources. And it is presumed that the general method given above will enable him to make such trials without difficulty. *

(244.) It will be proper to attend to the following cautions:—

1. This method of finding the latitude should not be used when a great circle between the places of the body or bodies passes within two or three degrees of the zenith or pole of the heavens.

2. A heavenly body should not be observed for this purpose, when its altitude is less than 3° or 4° .

3. The distance run by the ship in the interval of the observations should not be more than 12 leagues or 36 miles; the interval itself should not be more than 8 or 9 hours. In determining the true course and distance in the interval, care should be taken to make a proper allowance for any currents or tides by which the place of the ship may have been affected.

The *log. sines*, &c. used in the computation should be taken out to the nearest 15 seconds of a degree or 1 second of time, which may be done at once by inspection. (See Nautical Tables.)

To find the Longitude of the Ship by Astronomical Observation.

(245.) The longitude of the ship is the angle which the meridian of the ship makes with the meridian of Greenwich at the pole of the earth, or the angle which the celestial meridian of the ship makes with the celestial meridian of Greenwich at the pole of the heavens. Let PYP' (see fig. Art. 84) be the celestial meridian of the ship, PBP' the celestial meridian of Greenwich; then the angle BPY is the longitude of the ship; *west*, because the left side of the figure is considered as west and the right side as east. In like manner BPT is the longitude *east* of another place, of which the celestial meridian is PTP' .

Let the mean sun be on the meridian PXP' ; then the angle XPY (expressed in time) is mean time at the ship in *west* longitude, XPT at the ship in *east* longitude, and at Greenwich. Hence it appears if from Greenwich mean time we subtract the same kind of time at the ship (supposed less than Greenwich time), that the remainder will be the *west* longitude of the ship in time; and if from ship mean time we subtract Greenwich mean time (supposed less than ship time), that the remainder will be the longitude in time *east* of the ship.

It follows therefore, that in order to determine the longitude, we must be able to find mean time for the ship and for Greenwich at the same instant. The most common way of finding mean time at the ship is by observing with a sextant the altitude of a heavenly body, when it is rising or falling with considerable rapidity; this observed altitude is corrected and the true zenith distance as ZX (see fig. Art. 95) is deduced; with this and the colatitude and polar distance, as PZ and PX , the hour angle ZPX may be computed (see App. 28), and thence mean time as in Arts. 201, 202. The

* It would be an useful exercise, and at the same time facilitate the method of finding the latitude by double altitudes, if the arcs (1) and (2) were computed annually for different bright stars lying in proper positions. The computation would then require simply the two last operations.

most common way at sea of finding mean time for Greenwich, is by means of a chronometer, the error of which fast or slow on Greenwich mean time is supposed to have been known when the ship sailed, and also its *rate*, that is, its daily gain or loss on mean time; so that by making the proper allowances for this error and rate, Greenwich mean time may be deduced from the chronometer at any subsequent period. At the instant therefore of observing the altitude, the time by the chronometer is noted, and thus we have the means of determining the corresponding mean times at the ship and at Greenwich, and thence the longitude of the ship. The necessary steps in the observation and computation are described in the following rule.

To find Longitude by Chronometer.

(246.) When a heavenly body bears as nearly *east* or *west* as possible (always farther from the meridian than two points of bearing), observe its altitude, twice or thrice with a sextant, and at the same instant let the time shown by a chronometer be noted. Add the altitudes observed together, and also the times noted; divide each sum by the number, and thus get the means.

(247.) **RULE.** Get a **Gr.** date as in Art. 185 or note thereto. To the time by chronometer apply its error* on Greenwich mean time at the instant of observation; if necessary adding or subtracting 12^h , so as to bring the result to the proper Greenwich mean time known nearly from the date just got. For the resulting Greenwich date by chronometer, take the necessary elements from the Nautical Almanac as follows:—

(248.) *For the Sun:* the sun's declination as in Art. 186, the sun's semidiameter and equation of time as in Art. 190 (see note Art. 190).

For the Moon, a Planet, or Fixed Star: the right ascension of the mean sun (see Art. 191); the right ascension and declination of the body observed as in Art. 186, &c. Correct the observed altitude as in Art. 211, and get the true zenith distance (**Z.D.**)

(249.) Under the latitude †, marked **N.** or **S.**, put the declination also marked according to its name **N.** or **S.** If the names be *like*, take the dif

* Put down the error of the chronometer at the Greenwich mean noon preceding the time of taking a departure from a known longitude, marking it *f* if *fast*; and *s* if *slow*. Under it put the daily rate, marking it *f* if *gaining*; and *s* if *losing*. When the names are *like*, take the sum and affix the common name to it; when the names are *unlike*, take the difference and affix the name of the greater. The result will be the error of the chronometer the next day at Greenwich mean noon, and so on. To a table so formed, ten or twenty days in advance, may be appended the amount of rate *gaining* (*f*) or *losing* (*s*) for 1, 2, 3, &c. hours.

Ex. { April 5,	$2^m 15^s.7 f$	$0^m 4^s.3 f$	$10^m 20^s.2 s$	$0^m 2^s.6 s$
	$3.5 f$	$6.6 s$	$10.1 f$	$8.2 f$
April 6,	$2 19.2 f$	$0 2.3 s$	$10 10.1 s$	$0 5.6 f$

From such a table, the required error of the chronometer at the observation may be easily found.

† The latitude at the time of observation for chronometer is supposed to be known by bringing up the last latitude by observation to this time by means of log account.

ference; if the names be *unlike*, take the sum. Under the result put the true zenith distance (Z. D.); take the sum and difference*. Add together the *log. secants* (rejecting 10 from each index) of the two first terms in the form, and the *halves* of the *log. haversines* of the two last terms (see note*, p. 107). With the sum as a *log. havers.* take out the corresponding angle in time, at the *top of the page* when the body is *west* of the meridian, and at the *bottom of the page* when the body is *east* of the meridian: call this the *hour angle W.* (see App. 28).

For the Sun: to the hour angle (which is apparent time) apply the *equation of time* with its proper sign as applied to apparent time (see note, Art. 190). The result will be ship mean time, to which prefix the proper astronomical day of the month.

For Moon, Planet, or Star: to the hour angle got as above, add the *right ascension of the body*, and from the sum (increased if necessary by 24^h) subtract the *right ascension of mean sun*. The remainder (diminished by 24^h if greater than 24^h) will be *ship mean time*, to which put the proper astronomical day of the month.

Under the resulting ship mean time put the Greenwich date in mean time got from chronometer. If the days of the month be different, put the more advanced one day back, and add 24 to the hours. Take the difference of the times, and from table of *log. haversines* take the corresponding arc in degrees. This will be the true longitude by chronometer, E. when ship mean time is the greater, and W. when ship mean time is the less.

Ex. 1. Oct. 15, 1835, at $4^h 40^m$ P. M. mean time nearly, in latitude $15^\circ 32'$ N. and longitude by account 83° E., a chronometer showed $11^h 10^m 55^s$, and the observed altitude of the sun's L. L. was $15^\circ 12' 30''$; the index correction was $+4' 10''$, and the height of the eye above the sea was 15 feet: required the true longitude.

On Oct. 2, at Gr. mean noon the chronometer was *slow* on Gr. mean time $1^m 22^s.6$, and its rate was $12^s.5$ gaining.

Sun's Decl. on Oct. 14, at Gr. mean noon $7^\circ 59' 11''$ S., on Oct. 15, $8^\circ 21' 33''$ S.; corresponding Eq. T. $13^m 48^s.7$ S. and $14^m 2^s.3$ S. (see note, Art. 190); semid $16' 4''$.

The rough Gr. date in mean time will be found to be Gr. Oct. 14, $23^h 8^m$. The amount of rate of chronometer from Oct. 2, mean noon, to Oct. 14, $23^h 8^m$, is $2^m 41^s.9$ *fast*; its original error was $1^m 22^s.6$ *slow*. Consequently, its error at the instant of observation is $1^m 19^s.3$ *fast*. The same error may be got by constructing a table of errors (as in note to Art. 247).

	Chronometer.	
Sh. Oct. 14, $28^h 40^m$	$11^h 10^m 55^s$	Decl. $8^\circ 20' 46''$ S.
Long. in T. 5 32 E.	1 19.3	Semid. 16 4
		Eq. T. $14^m 1^s.8$ S.
Gr. Oct. 14, 23 8.....23 9 35.7		Z. D. $74^\circ 34' 24''$

* And (if it be thought more convenient than taking the halves of haversines) take half this sum and half this difference. Then add together the *log. secants* of the two first terms in the form, and the *log. sines* of the two last terms in it, rejecting the tens from the index of sum. Take from the table the *arc in time*, corresponding to the result as a *log. haversine*, from the top of table when body is W. of meridian, and from bottom of table when body is E. of meridian. Proceed afterwards as in Rule above.

Lat. 15° 32' 0" N. } <i>sec.</i>	0.016160	4 ^h 45 ^m 22 ^s .5
Decl. 8 20 46 S. } —10	0.004624	Eq. T. 14 1.8 S
	4.879270	
23 52 46	4.631542	Sh. Oct. 15, 4 31 20.7
74 34 24		Sh. Oct. 14, 28 31 20.7
	9.531596	Gr. Oct. 14, 23 9 35.7
98 27 10 } $\frac{1}{2}$ <i>havers.</i>	H. Angle or App. T.	
50 41 38 } $\frac{1}{2}$ <i>havers.</i>	4 ^h 45 ^m 22 ^s .8 W.	Long. in T. 5 21 45
Long. 80 26 15 E.		

Ex. 2. May 12, 1835, at 8^h 0^m A. M. mean time nearly, in latitude 40° 25' 10" N. and longitude by account 95° 30' W., a chronometer showed 2^h 12^m 16^s, and the observed altitude of the sun's L. L. was 35° 20' 42"; the index correction was — 4' 20", and the height of the eye above the sea was 20 feet: required the true longitude.

On May 2, 1835, at Gr. mean noon the chronometer was *slow* on Gr. mean time 5^m 16^s.4, and its rate was 3^s.7 *losing*.

Sun's decl. on May 12, at Gr. mean noon 18° 1' 26" N., on May 13, 18° 16' 32" N.; corresponding Eq. T. 3^m 53^s.5 S. and 3^m 54^s.9 S.; semid. 15' 51".

The rough Gr. date in mean time is Gr. May 12, 2^h 22^m. The amount of the rate of chronometer from May 2, at Gr. mean noon, to May 12, at 2^h 22^m, is 37^s.3 *slow*: its original error is 5^m 16^s.4 *slow*. Consequently, its error at the instant of observation is 5^m 53^s.7 *slow*.

Chronometer.			
Sh. May 11,	20 ^h 0 ^m	2 ^h 12 ^m 16 ^s	Decl. 18° 2' 53" N.
Long. in T.	6 22 W.	5 53.7+	Eq. T. 5 ^m 53 ^s .7 S.
			Semid. 15' 51"
Gr. May 12,	2 22	2 18 9.7	Z. D. 54 33 26
Lat. 40° 25' 10" N.	} <i>sec.</i>	0.118443	20 ^h 6 ^m 17 ^s .5
Decl. 18 2 53 N.	} —10	0.021917	Eq. T. 3 53.7 S.
		4.793812	
22 22 17		4.442781	Sh. May 11, 20 2 23.8
Z. D. 54 33 26			Gr. May 11, 26 18 9.7
		9.376953	
76 55 43	} $\frac{1}{2}$ <i>havers.</i>	Hour Angle or App. T.	6 15 45.9
32 11 9		20 ^h 6 ^m 17 ^s .5 W.	
Long. 93° 56' 28" W.			

Ex. 3. Nov. 24, 1834, at 9^h 50^m A. M. mean time nearly, in latitude 50° 48' N., and longitude by account 2° 50' W. when a chronometer showed 9^h 51^m 50^s, the observed altitude of the moon's L. L. was 35° 42' 10" W. of meridian; the index correction was + 3' 40", and the height of the eye above the sea was 18 feet: required the true longitude. On Nov. 10, at Gr. mean noon, the chronometer was *fast* on Gr. M. T. 2^m 10^s.5, and its daily rate was 4.7^s *losing*. Allowing the daily rate of the chronometer, namely, 4.7 *slow*, to the original error 2^m 10^s.5 *fast*, and continuing this allowance day by day to Nov. 23, 22^h 1^m, the error at the instant of observation is 1^m 5^s.2 *fast*. R. A. of mean sun (see note, Art. 191) on Nov. 23, at Gr. mean noon 16^h 7^m 54^s, on Nov. 24, 16^h 11^m 51^s. R. A. of moon on

Nov. 23, at $21^{\text{h}} \dots 10^{\text{h}} 33^{\text{m}} 18^{\text{s}}$, at $22^{\text{h}} \dots 10^{\text{h}} 35^{\text{m}} 31^{\text{s}}$; corresponding declinations $14^{\circ} 38' 16''$ N. and $14^{\circ} 26' 7''$ N. Moon's hor. semid. on Nov. 23, at Gr. mean midn. $15' 50''.2$, on Nov. 24, at mean noon, $15' 55''.9$; corresponding hor. par. $58' 7''.0$ and $58' 28''.0$.

		Chronometer,		R. A. Mean Sun, 16 ^h 11 ^m 30 ^s	
Sh. Nov. 23, 21 ^h 50 ^m		9 ^h 51 ^m 50 ^s		R. A. Moon	10 35 11
Long. in T. 0 11 W.		1 5.2—		Decl. Moon	14° 28' 0'' N.
Gr. Nov. 23, 22 1 21 50 44.8				Hor. Semid.	15 55
				Hor. Par.	58 25
				Z. D.	53 16 19
Lat. 50° 48' 0'' N. }		<i>sec.</i> 0.199263	H. Angle	3 ^h 14 ^m 32 ^s .6 W.	
Decl. 14 28 0 N. }		—10. 0.013993	R. A. Moon	10 35 11	
		4.847987			
36 20 0		4.168135	Adding 24 ^h	37 49 43.6	
Z. D. 53 16 19		—	R. A. M. Sun	16 11 30	
		9.229378			
89 36 19 } <i>hav.</i>		Hour Angle	Sh. Nov. 23, 21 38 13.6		
16 56 19 } ¹ / ₂		3 ^h 14 ^m 32 ^s .6 W.	Gr. Nov. 23, 21 50 44.8		
			Long. in T.	0 12 31.2	
			Long. 3° 7' 48'' W.		

Ex. 4. Nov. 19, 1834, at $7^{\text{h}} 20^{\text{m}}$ A. M., mean time nearly, in latitude $54^{\circ} 2' \text{ N.}$ and longitude by account $45^{\circ} 10' \text{ W.}$, a chronometer showed $10^{\text{h}} 21^{\text{m}} 40^{\text{s}}$, and the observed altitude of the planet Mars was $39^{\circ} 50' 30''$, bearing S. W.; the index correction was $-2' 10''$, and the height of the eye above the sea was 17 feet: required the true longitude. On Nov. 1, at Gr. mean noon the chronometer was *fast* on Gr. M. T. $1^{\text{m}} 50^{\text{s}}.6$, and its daily rate was $7^{\text{s}}.9$ *losing*. The error continued, by allowing rate, up to Gr. Nov. 18, $22^{\text{h}} 21^{\text{m}}$ (see rough Gr. date) is 31^{s} *slow*. Decl. Mars on Nov. 18 at Gr. mean noon $23^{\circ} 42' 22'' \text{ N.}$, on Nov. 19, $23^{\circ} 44' 27'' \text{ N.}$, corresponding R. A. of Mars $7^{\text{h}} 33^{\text{m}} 38^{\text{s}}$, and $7^{\text{h}} 33^{\text{m}} 57^{\text{s}}$; corresponding R. A. mean sun $15^{\text{h}} 48^{\text{m}} 11^{\text{s}}.6$ and $15^{\text{h}} 52^{\text{m}} 8^{\text{s}}.2$.

Sh. Nov. 18, 19 ^h 20 ^m	22 ^h 21 ^m 40 ^s	R. A. Mean Sun, 15 ^h 51 ^m 52 ^s
Long. in T. 3 1 W.	0 31+	R. A. Mars 7 33 56
		Decl. Mars 23° 44' 18" N.
Gr. Nov. 18, 22 21 ... 22 22 11		Z. D. 50 16 46
Lat. 54° 2' 0" N. } sec.	0.231129	3 ^h 37 ^m 27 ^s .3 W
Decl. 23 44 18 N. } -10.	0.038389	7 33 56
	4.810651	
30 17 42	4.239312	Adding 24 ^h . 35 11 23.3
50 16 46		15 51 52
	9.319481	
80 34 28 } $\frac{1}{2}$ <i>hav.</i>	Hour Angle	Sh. Nov. 18, 19 19 31.3
19 59 4 }	3 ^h 37 ^m 27 ^s .3 W.	Gr. Nov. 18, 22 22 11
		Long. in T. 3 2 39.7
		Long. 45 39 55 W.

Remarks.

(250.) It has already been remarked (246) that the heavenly body, of which the altitude is taken for finding the longitude by chronometer, should not be nearer in bearing to the meridian than two points; if nearer than this, a small mistake in the altitude or in the latitude would produce, perhaps, too great an error in the resulting longitude. The most advantageous bearing of a heavenly body is due East or West.

(251.) Whenever it can be conveniently done, altitudes should be taken not only nearly east or west, but also on *both sides* of the meridian: by which means an error in the longitude from altitudes on one side will be partly or altogether cancelled by an error of an opposite kind on the other side. If the sun is observed in the morning, it should also be observed in the afternoon; if a fixed star is observed east of the meridian, another, if possible, should be observed west of the meridian, as nearly as possible at the same time, and at about an equal bearing. (See App. 29, 30, 31.)

(252.) The longitude determined by chronometer at sea in the morning, is usually carried forward by means of the log account to noon; and if determined in the afternoon, it is usually brought back to noon by means of the log account. The result is then inserted in the log book in the proper space, as longitude by chronometer. A similar remark may be extended to any other astronomical method of finding the longitude, and also the latitude determined by observations off the meridian.

Having explained in the preceding articles the method of finding at sea the longitude by chronometer, supposing its error on Greenwich mean time to have been known at sailing, and also its rate, it is necessary now to explain methods for determining such error and rate.

To find the Error of a Chronometer on Mean Time and its Rate by Single Altitudes.

(253.) By the daily rate of a chronometer is meant what it goes more or less than 24 hours in a mean solar day. If it goes more than 24 hours, its rate is said to be so much *gaining*; if less than 24 hours, its rate is said to be so much *losing*.

This rate is got by determining the error of the chronometer on mean time at the same place on different days. If the error remain unaltered, there is no rate; but if it change, we know from that change and the time elapsed how much it gains or loses in 24 hours.

Let an astronomical observation therefore be taken, from which mean time can be deduced, and at the instant of the observation let the hour, minute, and second shown by the chronometer be noted down. Then the difference between the mean time deduced from the observation, and the time by the chronometer, will be its error on mean time at the place where the observation is taken, fast or slow.

And if mean time at the place be converted into Greenwich mean time, by adding or subtracting the longitude in time, before the difference is taken, the result will be the error of the timekeeper on Greenwich mean time.

If the error be found on successive days at the same hour (which if possible should be done), write them down under each other, and the differences will be the daily rate required. If there be an interval of several days between two successive observations, the difference between the errors must be divided by the number of elapsed days.

When the observations are not made at the same hour of the day, a proportion must be made for the rate in the interval thus:—

If the number of hours elapsed require the difference of the errors, what will 24 hours require?

(254.) Mean time at any place may be deduced from the observed altitude of a heavenly body, as in Arts. 246, &c. By repeating such observations, therefore, on different days, and taking the corresponding times by the chronometer, its rate may be found.

Let a ship be supposed to be lying at anchor for a few days, where the horizon can be distinctly seen; then in order to find the rate of the chronometer, the altitude of the sun is taken with a good sextant, when it bears as nearly E. or W. as possible, and the observation is made with the greatest care and accuracy. At the same instant the time is taken by the chronometer.

From the altitude of the sun, the latitude of the ship, and the declination of the sun, compute mean time at the ship (Art. 249.) Take the difference between this and the time by the chronometer, and note it down fast or slow. Repeat the observation on as many days afterwards as possible, and note down the errors of the chronometer, thence deduced as before on ship mean time. From these the rate of the timekeeper is found as explained above.

(1.) *Ex.* May 19, 1834, at 7^h 20^m A.M. mean time, nearly, in latitude 45° 25' 10" N., and longitude 135° 26' 10" W., the mean of times by chronometer was 4^h 28^m 20^s.5, and the mean of observed altitudes of the sun's L. L. was 28° 32' 16"; the index correction was + 3' 20", and the height of the eye above the sea was 20 feet.

(2.) May 23, at the same place and at the same hour and minute, the mean of times by chronometer was 4^h 28^m 11^s.5, the mean of observed altitudes of the sun's L. L. was 29° 2' 10": the index correction and height of the eye above the sea were the same as on the 19th. Required the daily rate of the chronometer.

Sun's decl. on May 19, at Gr. mean noon 19° 43' 35".6 N.; on May 21, 19° 56' 21".9 N.; semid. 15' 49"; corresponding Eq. T. 3^m 51^s.5 S., and 3^m 48^s.9 S. Sun's decl. on May 23. at Gr. mean noon 20° 32' 37" N., on May 24, 20° 44' 0" N.; semid. 15' 48"; corresponding Eq. T. 3^m 37^s.8 S. and 3^m 33^s S.

From the ship mean time known nearly, and the longitude, a Gr. date is got as in Art. 185: for which the sun's declination, semid., and the Eq. T. are taken out as in Art. 186, &c. The observed altitude is corrected as in Art. 211, and the true zen. dist. got by subtracting the T. A. from 90°.

(1.) Decl. 19° 45' 55" N.; semid. 15' 49"; Eq. T. 3^m 51^s S. (note Art. 190); Z. D. 61° 14' 37".

45° 25' 10" N.	} sec.	0.153718	Hour Angle 19 ^h 25 ^m 17 ^s .8 W.
19 45 55 N.	} -10.	0.026371	3 51.0 S.
<hr/>		4.837408	
25 39 15		4.485181	Sh. May 18, 19 21 26.8
61 14 37		<hr/>	Chron. adding 12 ^h , 16 28 20.5
<hr/>		9.502678	
86 53 52	} $\frac{1}{2}$ <i>havers.</i>		Oct. 19 ^h 21 ^m ..2 53 6.3 slow
35 35 22			

(2.) Decl. 20° 46' 1" N.; semid. 15' 48"; Eq. T. 3^m 32^s.1 S. Z, D.
60° 44' 42".

45° 25' 10" N.	} sec.	0.153718	Hour Angle 19 ^h 24 ^m 20 ^s W.
20 46 1 N.	} -10	0.029174	3 32.1 S.
<hr/>		4.831347	
24 39 9		4.491098	Sh. May 22, 19 20 47.9
60 44 42		<hr/>	Chron. adding 12 ^h , 16 28 11.5
<hr/>		9.505337	
85 23 51	} $\frac{1}{2}$ <i>havers.</i>		At 19 ^h 21 ^m ..2 52 36.4 slow.
36 5 33			

By taking the difference of these two errors, it appears that in 4 mean solar days the chronometer has gained 29^s.9; and consequently that its average *daily rate* has been 7^s.5 gaining. By applying the longitude in time (supposed correct) to the ship mean time, on the last day of observation, adding W. and subtracting E., the Gr. mean time is easily got, and then the error of the chronometer on Gr. mean time: with which and the rate thus determined it is usual to go to sea; and then to find the longitude as explained in Art. 246, &c.

(255.) The above method of finding the rate of a timekeeper is liable to some objections; it has also certain advantages. It is objectionable on account of the unavoidable errors, which may be made in the altitude of the sun from observation, reading off, and also from the imperfection of the instrument used. There may also be an error in the latitude. It hence happens that the mean time at the ship deduced from the altitude may be in a small degree wrong, and the error may be greater or smaller at the second observation than at the first, or it may be of a different kind. A very accurate rate therefore cannot be expected from this method.

However, by observing several altitudes near to each other with a good instrument and the corresponding times by the chronometer, of which sets a mean is taken; by determining the latitude of the ship with as great accuracy as possible; and by working to the nearest second in the necessary calculation, the error of the result may be diminished so far as to be of no great consequence in a practical point of view.

The advantages of this mode of proceeding arise from the circumstance of the rate being determined without moving the chronometer from the place in which it is afterwards used. It is there subject to the same changes of temperature in the air, and to similar motions of the ship, to which it is subject at sea. Whereas when a chronometer is taken on shore for the purpose of ascertaining its rate with greater accuracy, it may be placed in a room much more warm or cold than the ship; also the shocks to which it is liable in passing from and to the ship are apt in some mea-

sure to alter the rate. Upon the whole therefore the seaman may have reason to be satisfied with the rate got in the manner pointed out above, by his own observations, better than with a rate found on shore with more exact instruments and by more exact methods.

It may be necessary to add, that in getting the rate in this way, the observations, if possible, should be taken every day, nearly at the same time of the day, and with the same instrument; and that a mean of the rates so deduced should be used on going to sea, with the error last found on Greenwich mean time.

To find the Error of a Chronometer on Mean Time, and its Rate, by Equal Altitudes.

(256.) If the time shown by a chronometer can be ascertained when a heavenly body passes the meridian of the place, the error of the chronometer on M. T. there may be found, the M. T. of the meridian passage being determined as in Arts. 203 and 204. And if errors be thus found on different days, the variation of such errors will be seen, and thence may be easily deduced the daily gain or loss of the chronometer on M. T., that is, its *rate*. Let the time by chronometer be supposed to be noted, when the heavenly body has any particular altitude E. of the meridian, and again when it has the same altitude W. of the meridian. The middle point of time, that is, half the whole time elapsed, added to the time E. of meridian, would evidently be the time by chronometer when the body passes the meridian, provided the body, as a fixed star, had no motion of itself in altitude, and the chronometer (as may be here supposed) went uniformly. This, however, would not be the case for a body, as the sun, which has a motion in declination affecting the altitude. The middle point of time must in this case require a correction for such motion in declination, in order to get the exact time of the meridian passage by the chronometer. Such correction is called the *equation of equal altitudes*, and may be computed by the rule given hereafter (see Art. 258). Before, however, we proceed to give such rule, it may be proper to say a few words on the mode of making the necessary observations with the sextant.

Mode of observing Equal Altitudes.

(257.) If the body observed be the sun, which is usually the case, proceed as follows:—When the sun's motion in altitude is considerable A. M., take the altitude of the lower limb (L. L.). Then set the index forward from 5' to 10' to an exact minute, and wait till the sun has risen to this new altitude. At the instant of its having done so, let an assistant note the time by the chronometer, as nearly as he can, to the nearest tenth of a second, and write it down with the altitude. Set the index again forward 5' or 10', and proceed as before, and thus take about five or six observations. In the afternoon, at something less than the distance in time from noon of the last morning observation, take the altitude again of the sun's L. L., and when it has come nearly to the last of the morning altitudes, set the index to this altitude exactly, and wait till there is a contact. At that instant let the assistant note the time by chronometer, and write the said time opposite to the corresponding time in the morning. Set the index back as far as it was set forward in the morning, and proceed as before; and thus go on till all the corresponding observations to the morning ones are got, or as many of them as possible.

The above observations have been supposed to be of single altitudes from some stationary place, as a ship at anchor.

In observing double altitudes on shore by means of an artificial horizon, the index may be set first to about twice the altitude taken roughly without the telescope. Then, putting in the telescope (supposed an inverting one), the U. L. of the image from the glasses of the sextant may be made nearly to touch the L. L. of the image from the artificial horizon. Then set the index forward exactly to a division for minutes, and wait for the contact. Let the time by chronometer be noted at the instant such contact takes place. Afterwards put forward the index $10'$ or $20'$, and proceed as above.

Rule for finding Equation of Equal Altitudes, &c. (See App. 32.)

(258.) Take the mean of the chronometer times at the *second* observations, and put it down on the left-hand side of the paper, as in the following examples (adding 12^h thereto if necessary). Under this put the mean of the chronometer times at the corresponding *first* observations, and subtract. Mark the remainder *El. T.* or elapsed time. Take half this, and mark it $\frac{1}{2}$ *El. T.*, which add to the mean of times at the first observations. The sum will be the *approximate* chronometer time of the meridian passage of the body observed. Then :

Either,

To mean of chronometer times at *first* observations apply the supposed error of chronometer on Gr. M. T. ; if necessary (as indicated by the longitude), add or subtract 12^h or 24^h , and affix the proper day of the month at Greenwich. The result will be the *first* Gr. date. To this add the $\frac{1}{2}$ *El. T.* and, if necessary, reject 24^h , and put the day of the month one forward. The result will be the *second* Gr. date.

Or,

From the estimated M. T. at the place, at the *first* observations, and the longitude, get the *first* Gr. date in M. T., as in Art. 185. To this add $\frac{1}{2}$ *El. T.* ; reject 24^h if necessary, and put the day of month one forward. The result will be the *second* Gr. date.

The sun being supposed to be the body observed*, take from the Naut. Almanac its *decl.* at the *first* Gr. date, and the *eq. of time* at the *second* Gr. date. When the Naut. Tables are opened for the purpose of getting the sun's decl. write down at the same time, under each other, and in a separate place, *prop. log.* of change of decl. in 24^h , *Gr. date log. for sun* corresponding to El. T. (elapsed time), and 1.47712. Mark the sum of these numbers (*a*), which sum, or (*a*), write down again and mark it (*b*). Under (*a*) put *log. sin.* of $\frac{1}{2}$ El. T., and at the same time under (*b*) the *log. tan.* of $\frac{1}{2}$ El. T. Again under (*a*) put *log. cotan.* of latitude, and under (*b*) *log. cotan.* of declination. Add each set of numbers, rejecting the tens from the indices of sums. Find from Naut. Tables, p. 16 (*qq*), the seconds corresponding to each result to the nearest hundredth as estimated by inspection. Mark the seconds + or —, according to the following directions :—

* When the body observed is a Planet, take out its decl. and R. A. and also the R. A. of mean sun.

- | | |
|---|---|
| (a) When decl. is <i>increasing</i> , and of same name with lat., mark seconds under (a) | - |
| When decl. is <i>increasing</i> , and of a different name from lat. | + |
| When decl. is <i>decreasing</i> , and of same name with lat. | + |
| When decl. is <i>decreasing</i> , and of a different name from lat. | - |
| (b) When decl. is <i>increasing</i> , and El. T. is less than 12^h , mark seconds under (b) | + |
| When decl. is <i>increasing</i> , and El. T. is greater than 12^h | - |
| When decl. is <i>decreasing</i> , and El. T. is less than 12^h | + |
| When decl. is <i>decreasing</i> , and El. T. is greater than 12^h | - |

When the two parts under (a) and (b) have the same signs, take their sum, to which affix the sign of either. When they have different signs, take their difference, to which affix the sign of the greater. The result will be the *equation of equal altitudes*. Apply this equation, according to its sign, to the approximate chronometer time of the meridian passage. The result will be the *correct* time by chronometer of the said passage. The difference between this and M. T. at the place of the same meridian passage computed as in Arts. 203, 204 (adding or subtracting from either 12^h or 24^h, so as to get the least difference), will be the error of the chronometer on M. T. at the place at the instant of the mer. passage.

By adding the long. in time, if W., to the M. T. at the place of the mer. passage, and subtracting it if E. (adding or subtracting 24^h if necessary), Gr. M. T. corresponding to the mer. passage at the place will be got; the difference between which, and the correct chronometer time thereof, will be the error of the chronometer on Gr. M. T. at the instant of the mer. passage at the place.

From errors on different days got as above, either on M. T. at the place or on Gr. M. T., the *rate* of the chronometer may be easily deduced, by dividing the whole change of error by the number of intervening days.

Ex. 1. Aug. 18, 1842, in lat. $50^{\circ} 48'$ N. and long. $1^{\circ} 6'$ W. equal altitudes of the sun were observed. The mean of the times by chronometer were A. M. $10^h 10^m 26^s.4$, and P. M. $2^h 23^m 36^s.4$, the chronometer being supposed *fast* on Gr. M. T. about $9^m 5^s$. Required the correct error of the chronometer on M. T. at the place of observation, and also on Gr. M. T. at the instant of the sun's mer. pass. at the place.

			Decl.		Eq. T.	
	h.	h. m. s.		0	h m. s.	
Mean P.M.	+12	14 23 36.4	Aug. 17	13 29 49.7 N.	18	3 39.74 A.
Mean A.M.	.	10 10 26.4	18	13 10 32.0 N.	19	3 26.44 A.
<hr/>					<hr/>	
El. T.	.	4 13 10	19 17.7 S.		13.30 S.	
<hr/>					0.07 S.	
† El. T.	.	2 6 35	.96983		Eq. T.	
Mean A.M.	.	10 10 26.4	.03713		0 0 0	
<hr/>			1.47712		3 39.67 A.	
Approx. Chr. Mer.	12 17 1.4		1.00696		Mer. Pass. 0	
Pass.	.				3 39.67 M.T.	
	h. m. s.		3.20191 (a)		3.20191 (b.)	
Mean A.M.	10 10 26.4		9.71988		9.78950	
Chr. on Gr. M. T.	0 9 5.0 <i>fast</i>		9.91147		10.62969	
<hr/>					<hr/>	
Gr. Aug. 17	22 1 21.4		Decl. 13 12 7 N.	2.83326	15.85 +	3.62146
† El. T.	2 6 35		<i>Decreasing.</i>		2.58 -	25.58 -
<hr/>					<hr/>	
Gr. Aug. 18	0 7 56.4		Eq. Eq. Alt. 13.27 +			
<hr/>			Approx. Chr. Mer. Pass. 0 17 1.40			
<hr/>			Corr. Chr. Mer. Pass. 0 17 14.67			
<hr/>			M. T. of Mer. Pass. 0 3 39.67			
<hr/>			Chr. on Ship M. T. 0 13 35.0 <i>fast.</i>			

By applying the long. in time, namely, $4^m 24^s$ W., or $+$ to Sh. M. T., it appears that the chronometer's error on Gr. M. T. is $9^m 11^s.0$ *fast*.

Ex. 2. Sept. 13, 1842, at the same place as above, mean of chronometer times A. M. was $11^h 10^m 50^s.5$, and P. M. was $1^h 13^m 4^s$. The mean time at the place A. M. was about $10^h 55^m$. Required the error as above, and also the daily rate of the chronometer.

	n.	h.	m.	s.	Decl.		Eq. T.	
Mean P. M. +	12	13	13	4	Sept. 12	4° 14' 52.4 N.	Sept. 13	4 5.36 S.
Mean A. M.		11	10	50.5	13	3 51 54.6 N.	24	0 0 (Art. 204)
El. T.		2	2	13.5		22 57.8 S.	Mer. Pass.	23 55 54.64 M.T.
½ El. T.		1	1	6.75		.89449		.89449
Mean A. M.		11	10	50.5		.01880		1.07124
								1.47712
Approx. Chr. Mer. } Pass.	12	11	57.25			.91329		
						21 59 S.	3.44285 (a)	3.44285 (b.)
Sh. Sept. 12		22	55	0		4 14 52.4 N.	9.42081	9.43644
Long.		4	24	W.			9.91147	11.16825
							s.	
Gr. Sept. 12		22	59	24	Decl.	3 52 53.4 N.	2.77513	18.13 +
½ El. T.		1	1	6.7	Decreasing.			0.97 -
							Eq. Eq. Alt. . .	17.16 +
Gr. Sept. 13		0	0	31	Approx. Chr. Mer. Pass.	24 11 57.25		
					Corr. Chr. Mer. Pass.	24 12 14.41		
					M. T. of Mer. Pass.	23 55 54.64		
					Chr. on Ship M. T.	0 16 19.77 fast		

By applying the long. in time, namely, $4^m 24^s$ W. to Sh. M. T. of mer. pass., it appears that the chronometer's error on Gr. M. T. is $12^m 55^s.77$ *fast*.

By comparing the errors on Aug. 18 and Sept. 13, it appears that the chronometer has gained $2^m 44^s.77$ on M. T. in 26 days, and consequently at the rate of $6^s.3$ per day. The note made therefore respecting the chronometer on going to sea would be this: Sept. 13, 1842, at Gr. mean noon* nearly, chronometer on Gr. M. T. $16^m 19^s.8$ *fast*; daily rate $6^s.3$ *gaining*.

If the body be a fixed star, the chronometer approximate time got as above will be the *correct* chronometer time of the mer. passage; the difference between which and the M. T. of mer. passage at the place got as in Art. 203, will be the error of chronometer on M. T. at the place, at the instant of the mer. passage of the star.

If the body be a planet, proceed as above to get the *equation of equal altitudes*, and find the M. T. of mer. passage according to Art. 203.

(259.) When the error of a chronometer on Gr. M. T. is supposed to be accurately known at the observation of equal altitudes, the correct Gr. M. T. corresponding to the mer. passage may be found by applying that error to the correct chronometer time thereof; and the difference between this and the M. T. at the place of the mer. passage got as above will be the longitude in time.

Ex. Let the error of the chronometer on Gr. M. T. at the mer. passage

* When the long. is considerable, the error at mean noon at place must be reduced to Gr. mean noon, by allowing rate for long. in time.

in the first of the above two examples be supposed $9^m 5^s.5$ *fast*. Then proceeding as just directed, the long. comes out in time $4^m 29^s.5$ *W.* or in degrees $1^\circ 7' 22''.5$ *W.*

Inferior Meridian Passage.

(260.) The error of chronometer may be sometimes found from equal altitudes of a body before and after its *inferior* mer. passage, in which case the *first* observations will be to the west of the meridian and the *second* observations to the east thereof. The rule given in Art. 258 applies also in this case, with the exception that the signs + or - to be affixed to the seconds under (a) and (b) are then different, being as below (see App. 33); and that the M. T. at the place of the *inferior* mer. passage must be found (see Art. 203), and the *second* Gr. date must correspond to it.

- | | | | | | |
|--|---|---|---|---|---|
| (a) When decl. is <i>increasing</i> and of same name with lat. mark seconds; under (a) | . | . | . | . | + |
| When decl. is <i>increasing</i> and of different name from lat. | . | . | . | . | - |
| When decl. is <i>decreasing</i> and of same name with lat. | . | . | . | . | - |
| When decl. is <i>decreasing</i> and of different name from lat. | . | . | . | . | + |
| (b) When decl. is <i>increasing</i> and El. T. greater than 12 ^h mark seconds under (b) | . | . | . | . | - |
| When decl. is <i>increasing</i> and El. T. less than 12 ^h | . | . | . | . | + |
| When decl. is <i>decreasing</i> and El. T. greater than 12 ^h | . | . | . | . | + |
| When decl. is <i>decreasing</i> and El. T. is less than 12 ^h | . | . | . | . | - |

Ex. Aug. 2, 1842, in lat. $54^{\circ} 20' N.$ and long. $6^{\circ} 40' E.$, the mean of chronometer times when the sun's altitudes were observed P. M. was $6^h 40^m 10^s.3$, and the mean of chronometer times of equal altitudes A. M. next day was $4^h 36^m 17^s.8$. The chronometer was supposed to be *slow* on Gr. M. T. $0^m 58^s$. Required the error of the chronometer on M. T. at the place of observation at the instant of the inferior mer. passage.

[illegible]

The method of finding the rate of a chronometer by observing with a *transit instrument* successive meridian passages of a heavenly body will be explained hereafter in the articles on the use of astronomical instruments.

To find the Longitude by Lunar Observation.

(261.) The moon describes an orbit round the earth from west through south to east, at the distance of about 240 thousand miles from the earth :

this orbit it completes in about 30 days, so that the angle it thus describes round the spectator on the earth in one day or 24 hours is about 12° . The moon seems to traverse the surface of the celestial concave, approaching heavenly bodies as stars, which lie to the east nearly in its track, at the rate of an arc of about 12° in 24 hours, and receding from others to the west lying also nearly in its track at the same rate. By means of a sextant the observer on the earth is enabled to measure the angle between the moon and one of these heavenly bodies, which angle is the same in degrees as the arc of a great circle reaching apparently from the moon to the body, and is therefore called their *apparent distance*.

To an observer supposed to be placed at the earth's centre the distance measured at the same instant would be somewhat different, since the two bodies would from this point be seen lower in their respective circles of altitude on account of refraction, and (with the exception of fixed stars) higher therein on account of parallax. The places of the bodies seen from the earth's centre are called their *true* places, and the distance taken at this point is called their *true distance*. The *apparent distance* is without much difficulty reduced to the *true distance*, provided the altitudes of the bodies are known, either by observation or by computation, at the instant the distance is measured on the earth's surface. Thus at any time when the moon and a proper heavenly body are seen, we have the means of ascertaining their true distance; and thence from the Nautical Almanac, which contains their distances for every third hour at Greenwich, we can deduce a Greenwich date in Greenwich mean time, subject only to the error arising from slight errors of the tables used in computing for the Nautical Almanac, and to others scarcely altogether avoidable by the observer as well as in the instrument used.

(262.) If the *true distance* got from observation be found exactly in the Nautical Almanac, the corresponding Greenwich mean time sought will be seen at once at the head of the column. But if the *true distance* cannot be found exactly, it is necessary to make a proportion for the change of distance from the one immediately preceding it, knowing from the Nautical Almanac the change of distance that takes place in three hours. In making this proportion, it is supposed that the distance changes uniformly, that is, in proportion to the time elapsed,* which in fact it does not exactly (see App. 35).

(263.) In its motion on the celestial concave, the moon approaches or recedes from bright stars lying nearly in its track most rapidly and most uniformly. Such stars therefore are selected for applying this method of getting Greenwich mean time: the distances of the moon from them are put down in the Nautical Almanac within such limits, that whenever the moon may be seen above the horizon, one if not two of these stars may be seen at the same time. The distances put down in the Nautical Almanac are likewise limited by the nature of the instrument used in the observation, and by the particular direction of the moon's motion with respect to the star.

Since the sun is never very far from the moon's track, it is made one of the bodies used in the lunar method. The same may be said of the planets which can be seen with sufficient distinctness for observing the distance of the moon from them.

* A correction for the error of this supposition may be taken from the Nautical Almanac, p. 556.

(264.) The Greenwich date in mean time being supposed to be known from an observed distance and necessary reductions by calculation, it is manifest that the error of a chronometer may be found on Greenwich mean time, supposing the hour, minute, and second to have been noted by it at the instant of the observation; which error may be used in getting the longitude by chronometer and the observed altitude of any heavenly body in a proper position, that is, bearing as nearly due east or west as possible: which longitude so found may be called the longitude by lunar observation carried *on* by chronometer; or if necessary carried *back* by chronometer, if the altitude for chronometer has been observed previous to the lunar distance.

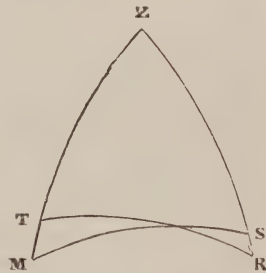
And such perhaps is the most simple way of considering the subject, when there is a chronometer on board to be so used.

(265.) But the longitude may be found independently of the chronometer, by computing ship mean time from one of the altitudes supposed to be observed at the same instant with the distance, and taking the difference between this and the Greenwich mean time got from the distance as pointed out above. For this method we shall first give a rule after the principle for computing the true distance from the apparent distance, or as it is commonly termed *clearing the distance*, has been explained.

Let *T* be the true place of the moon's centre as seen from the centre of the earth, and *R* that of the sun; then *TR* is the true distance of the centres, which corresponds to the distances put down in the Nautical Almanac, and from which Greenwich mean time is determined. The arc *MT* is part of a vertical circle *ZT*, and is the excess of parallax in altitude above refraction, by which the centre of the moon is raised when viewed from the centre of the earth. The arc *SR* is also part of a vertical circle *ZS*, and is the excess of refraction above parallax, by which the centre of the sun is depressed when viewed from the centre of the earth (see Art. 131). The point *Z* is the zenith. Supposing the altitudes of the sun and moon to be observed at the same instant the distance is taken, we know *ZM* and *ZS* the apparent zenith distance of the centres, by applying the index correction, semidiameter, and the dip. Hence in the triangle *ZMS* all the sides are given to find the angle *Z*. Again, applying to *ZM* and *ZS* the corrections *MT* and *SR* for refraction and parallax, we know *ZT* and *ZR*, which, with the included angle *Z*, enable us to compute the true distance *TR*. In this way by the common rules of trigonometry the true distance may be deduced from the apparent. But as such a method would be tedious and liable to error, several easier and more exact rules have been invented for doing the same, one of which, perhaps the best adapted for use at sea, will be given here.

Rule for finding the Longitude by Lunar Observation, when the Distance and both Altitudes are observed at the same instant, and Ship mean time is computed from one of the Altitudes. (See App. 34.)

(266.) *Observations made for Sun and Moon.* When the sun and moon are both seen above the horizon, and *within* distance (that is, when the distance is put down in the Nautical Almanac), bring with the sextant the darkened image of the sun to the moon without using a telescope. When



this is done, so that the nearest edges or limbs of the two bodies appear nearly to touch one another, clamp the index plate; put in and adjust the telescope; then by means of the tangent screw make an exact contact of the nearest points of the said limbs, taking care not to make the limbs overlap. At the same instant, let two assistant observers take the altitudes,* one of the sun's L. L., and the other of the moon's L. L. or U. L., as may be practicable. Read off and note down the arcs. When this is done, unclamp the index plate, and by the hand move it till the limbs a little overlap, and then again clamping by the tangent screw make a contact, taking care not to make the limbs open from each other; at the same instant let the altitudes be again observed. Repeat these operations once or twice, if possible. Take a mean of the readings off on each instrument. Determine the index correction, if any, of each instrument, supposing it to be unknown. If possible, take sets of observations as above for a body both east and west of the moon. (See Use of Sextant, Art. 334, &c.)

(267.) *Observations for Star or Planet and Moon.* Bring the image of the moon, a little darkened if necessary, up to the star or planet, by the hand and without the telescope, so that the enlightened limb may nearly touch the star or planet. Clamp the index plate: put in the telescope and adjust it; then, by the tangent screw, make the limb exactly touch or rather seem to pass through the middle of the star or planet.† Let assistant observers at the same time take the altitudes. Read off and note down the arcs. Unclamp, and by hand bring the limb so as to overlap the star and planet; again clamp, and by the tangent screw make a contact as before; let the altitudes be also again taken. Repeat these observations, if possible, two or three times. Take a mean of the readings off on each instrument. Determine the index correction of each instrument (see Art. 349, &c.).

If possible, get observations both east and west of the moon, as a slight error of observation, or in the index correction, may be thus corrected.

(268.) *Ship Time Altitude.* Select that one of the two bodies observed, which seems to have been the most advantageously situated, or to be on the whole the best for finding, from its altitude, ship mean time. This will depend on the true bearing, which should be as nearly as possible east or west: it will also depend on the clearness of the body and the horizon under it; and possibly it may be necessary to prefer that body whose altitude has been taken with a superior instrument, other circum-

* When it is inconvenient to observe the altitudes at the same instant with the distance, they may be observed a little before and a little after, at equal intervals of time measured by a watch or chronometer from the observation of distance: a mean, that is, *half the sum of two altitudes* of either body thus observed will then be the altitude required. If it be inconvenient to observe altitudes at equal short intervals on each side of distance, they may be taken at unequal short intervals. Let the interval between first altitude and distance be A, between the altitudes themselves be B; let the difference of the observed altitudes be D. Then add *prop. log.* of D to *prop. log.* of A, and from sum subtract *prop. log.* B; the remainder will be *prop. log.* of an arc, which take out, and when the body is rising add it to the first altitude, if the body be falling subtract it from first altitude; the result will be the observed altitude corresponding to distance. The body is supposed not to pass meridian in interval.

Time 3 ^h 10 ^m 15 ^s	3 ^h 11 ^m 50 ^s	3 ^h 13 ^m 42 ^s
Obs. Alt. 26° 40' 20"	Dist. 90° 25' 30"	Alt. 26° 15' 30"
A = 1 ^m 35 ^s	B. = 3 ^m 27 ^s	D = 24' 50"

Proceeding as in above rule arc required = 11' 24", and subtracting this from 26° 40' 20", the obs. alt. corresponding to distance is 26° 28' 56".

† It seems sufficiently exact to make the moon's limb pass through the middle of the visible disk of a planet with out attempting to make a contact with the enlightened limb.

stances being sufficiently favourable. The body thus selected by way of distinction may be called the *ship time body*.

When bodies both *east* and *west* of the moon are observed, one body east of meridian should be used in one calculation, and one west of meridian in the other.

(269.) *Computation.* Get a Gr. date, as in Art. 185, or as in note thereto. For this date take from the Nautical Almanac the following quantities.

(270.) *Sun and Moon observed.* The semidiameter of the sun, the horizontal semidiameter (to which at once apply augmentation) and horizontal parallax* of the moon. *If the sun be the ship time body*, the sun's declination and the equation of time (Art. 186, &c.). *If the moon be the ship time body*, the right ascension of the mean sun, and the right ascension and declination of the moon (Art. 191, &c.).

(271.) *Star and Moon observed.* The horizontal semidiameter (adding thereto augmentation) and horizontal parallax of the moon. *If star be the ship time body*, the right ascension of the mean sun, the right ascension and declination of the star. *If moon be the ship time body*, the right ascension of the mean sun, and the right ascension and declination of the moon (Art. 191).

(272.) *Planet and Moon observed.* The same as for star and moon, with the addition of the horizontal parallax of the planet (Art. 189, &c.).

(273.) *Correction of Altitudes.* Having noted down distinctly the quantities taken from the Nautical Almanac, write down in a line from left to right the observed altitude of the ship time body, that of the other body, and the observed distance. To each of these apply the proper index correction: then apply to the altitudes successively, the dip, the semidiameter (if any), adding if L. L. and subtracting if U. L.; mark the results A. A. Correct these for refraction and parallax as follows: *for sun*, subtract this correction in altitude (table *m*): *for the moon*, add this correction in altitude (see table *w*), and at the same time take from the same table the auxiliary angle A†: *for a star*, subtract this correction in altitude (table *n*): *for a planet*, subtract refraction, that is, correct as for a star, and then add parallax in altitude (Table *b*). Subtract each result from 90°, marking each remainder Z. D. (true zenith distance).

To the distance already corrected for index correction apply semidiameters as follows. *When sun and moon observed*, add the semidiameter of the sun, and also the semidiameter of the moon augmented. *When a star or planet and moon observed*, add the moon's augmented semidiameter if N. L. (nearest limb) is observed, and subtract the moon's augmented semidiameter when F. L. (farthest limb) is observed. Call the result in any case A. D. (apparent distance of centres.)

(274.) *Computation of True Distance* (see App. 34). Add together the two true zenith distances (Z. D.), and mark the sum *vers.*; add together

* The *hor. par.* taken from Naut. Almanac should in strictness be diminished by reduction taken from table (*h*). (See Naut. Tables.)

† The angle A is taken out first for degrees and minutes of moon's app. altitude and for minutes of moon's hor. par. Two additions are then made, one for seconds of hor. par. and the other for the altitude of sun or star found in a small table at the bottom of page of table. For a planet the latter addition or correction must be taken from table (*c*), entering with correction in planet's altitude for parallax at the top, and apparent altitude of planet at the side.

the two apparent altitudes (A. A.), under the sum put the correct auxiliary angle A., take the sum and difference, each of which mark *vers.*; under the apparent distance (A. D.) put the correct auxiliary angle A, take the sum and difference, each of which mark *vers.* From the proper table (*v*) take the last five figures of the *nat. versine* of the degrees and minutes of each arc* marked *vers.*, and put them under each other, at the same time taking from the right-hand page of the table the parts for the seconds of each arc, and writing them under each other at the side. Add each set of numbers and then add the sums, taking care to reject the tens in the fifth place to the left. The resulting five figures, or the next less to them, will be found in the column of *nat. versines* either immediately under the degree of the apparent distance, or in the column preceding that, or in the column following that. Write down the corresponding degrees and minutes, and then the seconds taken as usual from the opposite page. The result will be the true distance required.

(275.) *Computation of Greenwich Mean Time.* Find in the Nautical Almanac, on the given day, two distances of the moon and sun, or moon and star or planet, between which the true distance lies; that is, two distances, one of which is greater, and the other less, than the true distance. Under the true distance put the one which is placed first in the Nautical Almanac, and under this again the one that is the next in the Nautical Almanac. Take the difference between the first and second as they stand, and also the difference between the second and third. From the *prop. log.* of the 1st difference subtract the *prop. log.* of the 2nd difference. Find the hours, minutes, and seconds, answering to the remainder as a *prop. log.*, add them to the hour corresponding to the 1st distance taken from the Nautical Almanac, and to the sum put the day of the month as in the Nautical Almanac: the result will be Greenwich mean time expressed astronomically; which may be corrected, if thought material, by seconds from the Nautical Almanac p. 556 (see App. 35).

(276.) *Computation of Ship Mean Time.* From the true zenith distance (Z. D.) of the *ship time body* (supposed to be written down at the left-hand side of the paper) compute a correct date in ship mean time as in working a chronometer (see Art. 249).

To find the Longitude. Take the difference between Greenwich mean time and ship mean time, got as above, taking care first, if necessary, to reduce them to the same day of the month, by adding 24 to the least time and rejecting a day. This difference will be the longitude in time to be turned into degrees, by means of the table of *log. haversines*. The result will be the longitude W., when ship mean time is *less* than Greenwich mean time, and E. when ship mean time is *greater* than Greenwich mean time.

Ex. 1. March 13, 1834, at 3^h 15^m P. M. mean time nearly, in latitude 29° 50' N. and longitude by account 40° W. the following lunar observation was taken.

Obs. Alt. Sun's L. L.	Moon's L. L.	Obs. Dist. N. L.
34° 10' 40"	57° 2' 11"	35° 15' 40"
Ind. Corr. — 1 10	— 1 40	+ 0 40

The sun was sufficiently distant in bearing from the meridian for finding ship mean time from its observed altitude. The height of the eye above the sea was 17 feet: required the true longitude.

* If any of the arcs marked (*vers.*) be greater than 180°, it must be subtracted from 360°, and the remainder used instead of it.

Sun's decl. on March 13, at Gr. mean noon $2^{\circ} 59' 42'' .1$ S., on March 14, $2^{\circ} 36' 3'' .6$ S.; corresponding Eq. T. $9^m 45^s .4$ A. and $9^m 28^s .6$ A.; sun's semid. $16' 6''$. Moon's hor. semid. on March 13 at Gr. mean noon $14' 45'' .4$, on March 13 at Gr. mean midn. $14' 47'' .4$; corresp. hor. par. $54' 9'' .1$ and $54' 16'' .6$.

Sh. March 13, $3^h 15^m$ Sun's Decl. $2^{\circ} 53' 52.4$ S. Moon's sem. aug. $14' 58'' .4$
 Long. in T. $2 40$ W. Eq. T. $9^m 41^s .2$ A. Hor. Par. $54 12 .8$
 Sun's semid. $16' 6''$

Gr. March 13, $5 55$

	Sun's L. L. $34^{\circ} 10' 40''$	Moon's L. L. $57^{\circ} 2' 11''$	Dist. N. L. $35^{\circ} 15' 40''$	
Ind. Corr.	$1 10 -$	$1 40 -$	$0 40 +$	
	$34 9 30$	$57 0 31$	$35 16 20$	
Dip.	$4 4 -$	$4 4 -$	Sun's Semid. $16 6$	
	$34 5 26$	$56 56 27$	Moon's Semid. $14 58.4$ Aug ^d .	
Semid.	$16 6 +$	$14 58 +$	Ap. Dist. $35 47 24.4$	
A. A.	$34 21 32$	A. A. $57 11 25$	$60 25 7$	
Cor. in Alt.	$1 18 -$	$28 38 +$	$6 +$	
	$34 20 14$	$7 +$	$3 +$	
		$57 40 10$	A. $60 25 16$	
Z. D.	$55 39 46$			
		Z. D. $32 19 50$	64810	174
Lat. $29^{\circ} 50' 0''$ N.		Z. D. $55 39 46$	82674	030
Decl. $2 53 52$ S.			43883	102
		$87 59 36$ Vers.	07999	195
	$32 43 52$		90885	104
Z. D.	$55 39 46$	A. A. $57 11 25$		
		A. A. $34 21 32$	90251	605
	$88 23 38$		605	
	$22 55 54$	$91 32 57$		
		A. $60 25 16$	90856	
	0.061742		$35 59 16$ T. Dist.	
	0.000555	$151 58 13$ Vers.	$35 56 58$ VI.	
	4.843311	$31 7 41$ Vers.	$37 18 0$	
	4.298380			
	9.203988	$35 47 24.4$	$2 18$	1.89354
H. Angle $3^h 8^m 35.5$		$60 25 16$	$1 21 2$	34661
Eq. T. $9 41.2$ A.		$96 12 40.4$ Vers.	$5 6.5$	1.54693
		$24 37 51.6$ Vers.	6	
Sh. Mar. 13, $3 18 16.7$				
		Gr. March 13, $6 5 6.5^*$		
		Sh. March 13, $3 18 16.7$		
		Long. in T. $2 46 50$		
		Long. $41^{\circ} 42' 30''$ W.		

Ex. 2. Oct. 9, 1834, at $6^h 15^m$ P. M. mean time nearly, in latitude $40^{\circ} 10'$ S. and longitude by account $43^{\circ} 45'$ W. the following lunar observation was taken.

Obs. Alt. α Pisc. Aust.	Moon's L. L.	Obs. Dist. F. L.
(Fomalhaut) E. of mer.		
$48^{\circ} 5' 30''$	$65^{\circ} 2' 35''$	$46^{\circ} 2' 50''$
Ind. corr. $- 1 20$	$+ 1 10$	$- 0 40$

* Supposing a chronometer the instant of the observation to have shown $6^h 1^m 20^s$, its error on Gr. mean time would be found from this result to be $3^m 46^s .5$ slow, using which error the longitude by chronometer might afterwards be found as in Art. 246, &c.

The star was sufficiently distant in bearing from the meridian for the purpose of computing ship time from its observed altitude. The height of the eye above the sea was 19 feet: required the true longitude.

R. A. mean sun on Oct. 9, at Gr. mean noon $13^h 10^m 29^s.5$, on Oct. 10, $13^h 14^m 26^s.0$. R. A. α Pisc. Aust. $22^h 48^m 30^s.2$. Decl. α Pisc. Aust. $30^\circ 29' 50''$ S. Hor. semid. moon on Oct. 9, at Gr. mean noon $15' 35''.4$, on Oct. 9, at Gr. mean midn. $15' 28''.6$; corresponding hor. par. $57' 12''.8$ and $56' 47''.6$.

Sh. Oct. 9, $6^h 15^m$ R. A. mean sun $13^h 12^m 0^s$ Aug. sem. moon $15' 44''.4$
 Long. in T. $2 55$ W. R. A. star $22 48 30.2$ Hor. par. moon $56 53 .6$
 Dec. star $30^\circ 29' 50''$ S.

Gr. Oct. 9, 9 10

Star.	Moon's L. L.	Dist. F. L.
$48^\circ 5' 30''$	$65^\circ 2' 35''$	$46^\circ 2' 50''$
Index Corr. 1 20 -	1 10 +	0 40 -
48 4 10	65 3 45	46 2 10
Dip. 4 17 -	4 17 -	15 44.4 -
A. A. 47 59 53	64 59 28	45 46 25.6
52 -	15 44 +	
47 59 1	A. A. 65 15 12	60 28 14
Z. D. 42 0 59	23 0 +	27.5 +
	23 +	0
Lat. $40^\circ 10' 0''$ S.	65 38 35	A. 60 28 41.5
Decl. $30 29 50$ S.	Z. D. 24 21 25	
9 40 10	Z. D. 42 0 59	
42 0 59		
51 41 9	66 22 24 <i>Vers.</i>	99118 107
32 20 49	A. A. 65 15 12	93993 025
0.116809	A. A. 47 59 53	94938 090
0.064670		79829 033
4.639390	113 15 5	32732 019
4.444898	A. 60 28 41.5	00610 274
9.265767	173 43 46.5 <i>Vers.</i>	00884
Hour Ang. $20^h 36^m 33^s$ W.	52 46 23.5 <i>Vers.</i>	$45^\circ 38' 38''$ T. Dist.
R. A. Star 22 48 30.2	45 46 25.6	45 45 50 IX.
	60 28 41.5	44 16 23
43 25 3.2		0 7 12 1.39794
R.A.M. Sun 13 12 0	106 15 7 <i>Vers.</i>	1 29 27 .30023
	14 42 16 <i>Vers.</i>	
Sh. Oct. 9, 6 13 3.2		0 14 22.5 1.09771
		9
		9 14 22.5
	Corr from Naut. Alm. p. 556,	- 3.5
	Gr. Oct. 9 . . . 9 14 19	
	Sh. Oct. 9 . . . 6 13 3.2	
		3 1 15.8
	Long. 45 18 57 W.	

* Supposing a chronometer at the instant of the observation to have shown $9^h 20^m 22^s.5$, its error on Gr. mean time would be found from this result to be $6^m 3^s.5$ fast; using which error the longitude by chronometer might afterwards be found as in Art. 246, &c.

Ex. 3. Sept. 22, 1834, at 2^h 15^m A. M. mean time nearly, in latitude 24° 50' N. and longitude by account 37° 30' E. the following lunar observation was taken :

Obs. Alt. Mars, E. of Mer.	Moon's L. L.	Dist. N. L.
32° 10' 40''	70° 10' 40''	49° 42' 10''
Ind. Corr. — 1 10	— 2 40	+ 1 10

Mars was in a proper position for finding ship mean time from its observed altitude. The height of the eye above the sea was 18 feet: required the true longitude.

R. A. mean sun on Sept. 21, at Gr. mean noon 11^h 59^m 32^s, on Sept. 22, 12^h 3^m 28^s; corresponding R. A. of Mars 6^h 7^m 19^s and 6^h 9^m 35^s; corresponding decl. of Mars 23° 28' 59'' N. and 23° 29' 55'' N; hor. par. of Mars 7''.5; moon's hor. par. on Sept. 21 at Gr. mean noon 14' 43''.6, at Gr. mean midn. 14' 45''; corresponding hor. par. 54' 2'' and 54' 7''.

Sh. Sept. 21, 14 ^h 15 ^m	R. A. mean sun 12 ^h 1 ^m 27 ^s	Hor. Par. Mars. 0' 7''. 5
Long. in T. 2 30 E.	R. A. Mars 6 8 25	Aug ^d . Sem ^r . Moon 14 58
	Decl. Mars 23° 29' 26'' N.	Hor. Par. Moon 54 7

Gr. Sept. 21, 11 45	Mars.	Moon's L. L.	Obs. Dist. N. L.	
	32° 10' 40''	70° 10' 40''	49° 42' 10''	
	1 10 —	2 40 —	1 10 +	
	32 9 30	70 8 0	49 43 20	
	4 11 —	4 11 —	14 58 +	
A. A.	32 5 19	70 3 49	Ap. Dist. 49 58 18	
Refr.	1 33 —	14 58 +	60 28 13	
	32 3 46	A. A. 70 18 47	4	
Par.	7 +	17 52 +	3	
	32 3 53	2 +	A. 60 28 20	
		70 36 41		
Z. D.	57 56 7	Z. D. 19 23 19	80438	123
		Z. D. 57 56 7	55622	038
Lat.	24° 50' 0'' N.		55883	148
Decl.	23 29 26 N.		49117	173
		77 19 26 <i>Vers.</i>	16745	002
	1 20 34			
	57 56 7	A. A. 70 18 47	57805	484
		A. A. 32 5 19	484	
	59 16 41			
	56 35 33	102 24 6	58289	
		60 28 20	T. Dist. 50° 4' 50''	
	0.042137		51 1 53 IX.	
	0.037575	162 52 26 <i>Vers.</i>	49 36 54	
	4.694194	41 55 46 <i>Vers.</i>		
	4.675804		0 57 3	.49902
		49 58 18	1 24 59	.32594
	9.449710	60 28 20		
H. Angle,	19 ^h 43 ^m 34 ^s .5 W.		2 0 50	.17308
	6 8 25	110 26 38 <i>Vers.</i>	9	
		10 30 2 <i>Vers.</i>		
	25 51 59.5	Gr. Sept. 21, 11 0 50*		
	12 1 27	Sh. Sept. 21, 13 50 32.5		
Sh. Sept. 21, 13 50 32.5			2 49 42.5	
			Long. 42 25 37 E.	

* Supposing a chronometer to have shown 11^h 1^m 55^s at the instant of the observation, its error on Gr. mean time would then have been 1^m 5^s fast.

Ex. 4. March 11, 1835, at 6^h 10^m P.M. in latitude 10° 15' S. and longitude by account 3° 30' E. the following lunar observation was taken.

Obs. Alt. Moon's L. L.	Mars.	Dist. N. L.
Bearing S. E. b. E.	S. b. E.	
32° 20' 10"	47° 15' 40"	31° 16' 50"
— 1 15	+ 1 10	+ 0 30

The height of the eye above the sea was 16 feet: required the true longitude.

R. A. mean sun March 11, at Gr. mean noon 23^h 13^m 42^s.5, on March 12, 23^h 17^m 39^s.1; R. A. moon, on March 11, at Gr. 5^h, 8^h 45^m 20^s.3, on March 11, at Gr. 6^h, 8^h 47^m 33^s.5, corresponding decl. moon 22° 20' 57".6 N. and 22° 13' 34".8 N. hor. semid. moon on March 11, at Gr. noon 15' 43".8, on March 11, at Gr. midn. 15' 51".1, corresponding hor. par. 57' 43".5 and 58' 10".4, hor. par. Mars on March 11, 10".6.

Sh. March 11, 6 ^h 10 ^m	R. A. mean Sun, 23 ^h 14 ^m 41 ^s	Aug ^d . Semid. Moon 15' 56"
Long. in T. 0 14 E.	R. A. Moon 8 47 34	Hor. Par. Moon 57 57
	Decl. Moon 22° 14' 4" N.	Hor. Par. Mars 10 6

Gr. March 11, 5 56

Moon's L. L.	Mars.	Dist. N. L.
32° 20' 10"	47° 15' 40"	31° 16' 50"
1 15 —	1 10	0 30 +
32 18 55	47 16 50	31 17 20
3 56 —	3 56 —	15 56 +
32 14 59	A. A. 47 12 54	Ap. Dist. 31 33 16
15 56 +	0 53 —	60° 16' 44"
A. A. 32 30 55	47 12 1	18 +
46 34 +	5 +	2 +
48 +	47 12 6	A. 60 17 4
33 18 17	Z. D. 42 47 54	64761 177
Z. D. 56 41 43	Z. D. 56 41 43	66044 165
		56971 073
Lat. 10° 15' 0" S.	99 29 37 <i>Vers</i>	31992 097
Dec. 22 14 4 N.		22994 111
32 29 4	A. A. 32 30 55	
56 41 43	A. A. 47 12 54	42762 623
	79 43 49	43385
89 10 47	60 17 4	T. Dist. 31° 3' 41"
24 12 39	140 0 53 <i>Vers.</i>	30 48 33 VI
0.006987	19 26 45 <i>Vers.</i>	32 28 28
0.033533		0 15 8 1.07534
4.846353	31 33 16	1 39 55 .25563
4.321621	60 17 4	
9.208494	91 50 20 <i>Vers.</i>	0 27 16 .81971
H. Angle 20 ^h 50 ^m 22 ^s W.	28 43 48 <i>Vers.</i>	6
8 47 34		6 27 16
29 37 56	Corr. from Naut. Alm. p. 6	+ 2.7
23 14 41		Gr. March 11, 6 27 18.7*
		Sh. March 11, 6 23 15
Sh. Mar. 11, 6 23 15		4 3.7
	Long.	1° 0' 55".5 W.

* Supposing a chronometer to have shown 6^h 20^m 15^s, at the instant of the observation, its error on Gr. mean time would have been then 7^m 3.7^s slow.

To find the Longitude by Lunar Observation, when the Altitudes are determined by Calculation. (See App. 36.)

(277.) From the observed altitude of any heavenly body advantageously situated (see Art. 246, &c.) find the ship mean time, and take the difference between this and the time shown by the chronometer. The result will be the error of the chronometer on ship mean time. Let this be done either before the lunar distance is observed or after it, as near thereto as circumstances allow.

When the lunar distance is observed, note the time by chronometer.

Get a Greenwich date in mean time, and for it take from the Nautical Almanac the moon's horizontal semidiameter and horizontal parallax; (except for the sun) the right ascension and declination of each body, and the right ascension of the mean sun. *For the sun*, only its declination and the equation of time.

(278.) Apply the error* of the chronometer to the time shown by it at the instant of the observation of the lunar distance, *adding* what it may be slow, and *subtracting* what it may be fast. The result will be the correct ship mean time corresponding to the observation of the distance. Express this astronomically, and add it (except for the sun) to the *right ascension of mean sun*. From the sum (increased if necessary by 24 hours) subtract the *right ascension of the body*: the remainder (diminished by 24 hours if greater than 24 hours) will be the *hour angle of the body* reckoned W. from the meridian. *For the Sun*: to the ship mean time apply the *equation of time* with a *contrary* sign (see note, Art. 190): the result will be the *hour angle* reckoned W. from the meridian.

Under the latitude † put the declination of the body, marking each with its proper name N. or S. When the names are *like*, take the *difference*; when the names are *unlike*, take the *sum*: mark the result M.Z. (meridian zenith distance).

(279.) For each body, add together *log. cos.* of lat., *log. cos.* of decl., and *log. havens.* of hour angle, rejecting the *tens* in the index of sum. The result will be the *log. havens.* of an arc, which take from the table in degrees. To the *nat. versine* of this arc add *nat. versine* of M.Z. The result will be *nat. versine* of the body's true zenith distance (Z.D.). It will be sufficient to take it out to the nearest minute. Subtract each Z.D. from 90°,

* If the ship has run any distance *in longitude* in the interval between the observations, the error of chronometer on ship mean time must be corrected by that run turned into time: *add*, if the place of the ship at the observation of the distance be E. of its place at observation of time altitude; *subtract*, if W. Also if the chronometer has been supposed to gain or lose in the interval, correct also for amount of gain or loss, adding when the chronometer is slower at distance observation than at altitude observations, and subtracting when faster. The result will be the error at distance observation.

† The latitude at the observations should be determined with as great accuracy as possible, by astronomical observations brought either up to the time or back to the time (if necessary) by the log account.

the remainder will be the true altitude (T. A.), which correct for parallax and refraction as follows. First, enter the proper table with each altitude, and take out the corresponding correction roughly to nearest minute, which correction suppose to be applied with a contrary sign (adding where it should be subtracted and subtracting where it should be added). Enter the table again with each result, and take out the corrections accurately, which actually apply in the same manner to the true altitude (T. A.); then each result will be accurately the apparent altitude, which mark A. A. At the time the correction in altitude for the moon is found in the table, take out also the auxiliary angle A (see note, Art. 273).

Proceed then as in Art. 274 to compute the true distance and get a correct Greenwich date in mean time, under which put the correct ship date in mean time got from the chronometer: the difference will be the longitude in time, which turn into degrees by means of table of *log. haversines*; marking the result E. when ship mean time is the greater, and W. when ship mean time is the less.

Or, find the error of the chronometer on Greenwich mean time, which is the difference between the time shown by chronometer and the Greenwich mean time got from distance; and then using this error find the longitude by chronometer, whenever a favourable opportunity of taking an altitude occurs, calling the resulting longitude the longitude by lunar observation carried on by chronometer.

Ex. Feb. 10, 1835, at $11^h 15^m$ P. M. mean time nearly, in lat. $45^\circ 28'$ N. and longitude by account $169^\circ 30'$ E. when a chronometer showed $0^h 12^m 30^s$ the observed distance of the moon's F. L. from α Leo (Regulus) was $44^\circ 0' 10''$, the index correction being $- 0' 40''$. On the same day at $11^h 58^m$ P. M., when the chronometer showed $0^h 53^m 16^s$ the observed altitude of α Taurus (Aldebaran) was $21^\circ 9' 40''$ bearing about W., the index correction being $- 0' 40''$ and the height of the eye above the sea 14 feet. The run of the ship in the interval of the two observations was $15'$ W. in longitude, and the daily rate of the chronometer was 12 seconds losing. Required the true longitude at the time of the observation of the distance, and also the error of the chronometer on Greenwich mean time at that instant.

It is first necessary to find from the observed altitude of α Taurus (Aldebaran) the error of the chronometer on ship mean time, which will be found to be $11^h 18^m 31^s.7$ *slow*. Adding this to the time shown by it when the distance was observed, namely, $0^h 12^m 30^s$, the result is $11^h 31^m 1^s.7$ ship mean time (at the instant the distance was taken) for the place of the altitude observation. Adding 1 *min.* for $15'$ of longitude which the distance was observed *eastward* of the altitudes, and subtracting 0.4 *sec.* for the rate of the chronometer in the interval, the result is $11^h 32^m 1^s.3$ ship mean time corresponding to the distance.

For this ship mean time the altitudes are then computed by Art. 278, &c., and the true distance computed, from which Gr. mean time is got, the difference between which and the ship mean time is the longitude in time, &c. (See principal parts of computation on the next page.)

For Ship Mean Time by Altitude.

Sh. Feb. 10, 11 ^h 58 ^m	R. A. Mean Sun, 21 ^h 19 ^m 29 ^s .2
Long. in T. 11 17 E.	R. A. α Taurus, 4 26 27.3
	Decl. α Taurus, 16° 10' 17" N.
Gr. Feb. 10, 0 41	Z. D. 68 57 11
Lat. 45° 28' 0" N.	0.154081
Decl. 16 10 17 N.	0.017532
	4.878602
29 17 43	4.530477
68 57 11	9.580692
98 14 54	Hour Angle
39 39 28	5 ^h 4 ^m 49 ^s .6
	Sh. Feb. 10, 12 11 47.7
	Chr. 0 53 16

Error, 11 18 31.7 *slow*.*The Greenwich Mean Time by Distance.*

Chr. . . 0 ^h 12 ^m 30 ^s	R. A. M. Sun, 21 ^h 19 ^m 24 ^s .8	11 ^h 32 ^m 1 ^s .3
Slow . . 11 18 31.7	R. A. α Leo. . 9 59 35.5	21 19 24.8
	Decl. α Leo. 12° 46' 14" N.	
11 31 1.7	R. A. Moon . 7 ^h 2 ^m 0 ^s .3	32 51 36.1
Run. . 1 0 +	Decl. Moon . 25° 8' 37" N.	9 59 35.5
Rate . . 0.4-	Hor. Sem. 15 27.2	
	Hor. Par. . 56 42.5	H. Ang. α } 22 52 0.6
Sh. Feb. 10, 11 32 1.3		Leo. . }
Long. in T. 11 18 0 E.		32 51 36.1
		7 2 0.3
Gr. Feb. 10, 0 14 1.3		

H. Ang. Moon 1 49 35.8

α Leo.	Moon.	Z. D. 29° 57' 0"
Lat. 45° 28' 0" N.	45° 28' 0" N.	Z. D. 35 44 0
Decl. 12 46 14 N.	25 8 37 N.	65 41 0 <i>Vers.</i>
M. Z. 32 41 46	M. Z. 20 19 23	A. A. 59 34 51
9.845919	9.845919	A. A. 54 16 41
9.989121	9.956773	113 51 32
8.339298	8.748907	60 27 8
8.174338	8.551599	88220
14° 2' 30"	21° 45' 37"	000
0029880	0071256	174 18 40 <i>Vers.</i>
0158450	0062253	53 24 24 <i>Vers.</i>
0188330	0133509	03775
Z. D. 35° 44' 0"	Z. D. 29° 57' 0"	App. D. 43 43 50
T. A. 54 16 0	60 3 0	60 27 8
41+	28 9-	104 10 58 <i>Vers.</i>
A. A. 54 16 41	A. A. 59 34 51	16 43 18 <i>Vers.</i>
Obs. Dist. 44 0 10	60 26 47	T. Dist. 43 29 12
40-	21	43 40 44..0 ^h
43 59 30	A. 60 27 8	42 3 22
15 40-		0 11 32
A. Dist. 43 43 50		1 37 22
		0 21 19.5
		Gr. Feb. 10, 0 ^h 21 ^m 19 ^s .5
		Sh. Feb. 10, 11 32 1.3
		Long. in T. 11 10 41.8
		Long. 167 40 27 E.

Error of Chr. on Gr. M. T. 8^m 49^s.5 *slow*.

(280.) Brief directions have been given in the rules just laid down, to take, if possible, altitudes for ship time of bodies bearing as nearly east or west, and both east and west of the meridian: it is equally important to observe distances from the moon, of bodies both east and west of it, in order to get Gr. time more exactly. The reasons of the former recommendation have been already given in Art. 251: the reasons for the latter are these:—Should the distance observed from a body east of the moon be too little, either through a bad habit of observing in the person who takes the distance, or from some unknown error in the instrument (from which none is altogether free), similar errors may be expected to be introduced into the distance observed from a body west of the moon, that is, this distance will be also too little. Now the error *east* of moon in defect will make the Greenwich time too far advanced, as it makes the moon too far advanced in its course from west to east towards the other body, and a similar error *west* of the moon must have just the contrary effect. One error, therefore, will correct the other. Similar remarks may be applied to the amount of errors in excess, that is, which make the distance too great.

To find both the Latitude and Longitude from a Lunar Observation, both the Altitudes and the Distance being supposed to be observed.* (See App. 37.)

(281.) From ship mean time supposed to be known nearly, and the longitude by account, or from the chronometer, get a Greenwich date, for which take from the Nautical Almanac all the quantities specified in Art. 270, &c., and also the declination of that body which is *not* the ship time body. Correct the observed altitudes, &c., and compute the true distance as by Art. 274. With this true distance as arc (1) proceed as in the rule for working a double altitude, beginning with the computation of arc (2); for which part of the work the true zenith distances, and polar distances known from the declinations, will be sufficient; the polar angle is not required.

When the latitude is thus determined, use it in computing, from the true zenith distance (Z. D.) of the ship time body, the correct ship date in mean time, and under this put the correct date in Greenwich mean time got from the true distance. The difference will be the longitude in time, which turn into degrees by means of the table of *log. haversines*; and mark the resulting longitude E. when ship mean time is the greater, and W. when ship mean time is the less.

Ex. Feb. 4, 1835, in N. latitude, A. A. sun's cr. $20^{\circ} 2' 46''$ bearing S. W. b. S.; A. A. moon's cr. $30^{\circ} 13' 34''$ bearing S. E. $\frac{1}{2}$ E.; *app. dist.* $76^{\circ} 48' 10''$; sun's decl. $16^{\circ} 19' 24''$ S.; moon's declination $8^{\circ} 45' 21''$ N., equation of time $14' 14''.1$ A., hor. par. $54' 11''.9$. Tr. dist. from Naut. Almanac at 0^h , $75^{\circ} 48' 3''$, at III, $77^{\circ} 8' 56''$: required the latitude and longitude. By proceeding as in the foregoing examples the true distance will be found to be $76^{\circ} 37' 12''$, and Greenwich mean time $1^h 49^m 22^s.5$;

* The true bearings of the bodies must be conformable to the limits given in Art. 226.

considering $76^{\circ} 37' 12''$ as arc (1) in the application of rule for double altitude, the following part of the process will give the latitude and ship mean time, &c.

To find arc (2).	To find arcs (3) and (4).	To find Lat.	To find Sh. M. T.
$76^{\circ} 37' 12''$	$76^{\circ} 37' 12''$		$50^{\circ} 48' 9''$ N.
81 14 39	59 1 16	9.994904	16 19 24 S.
		9.933160	
4 37 27	17 35 56	8.949214	67 7 33
106 19 24	69 59 44		69 59 44
		8.877278	
110 56 51	87 35 40	$51^{\circ} 52' 18''$	137 7 17
101 41 57	52 23 48	0150767	2 52 11
		0074263	
0.011950	0.011950		0.199302
0.005096	0.066840	0225030	0.017872
4.915856	4.840175	$39^{\circ} 11' 51''$	9.968858
4.889577	4.644911	Lat. 50 48 9 N.	8.398641
9.822479	9.563876		8.584673
2) $109^{\circ} 12' 18''$	(3) $74^{\circ} 29' 52''$	Hour Aug. $1^h 30^m 26^s$ W.	
	(2) 109 12 18	Eq. T. 14 14.1 A.	
	(4) 34 42 26	Sh. Feb. 4, 1 44 40.6	
		Gr. Feb. 4, 1 49 22.5	
			4 42
			Long. $1^{\circ} 10' 30''$ W.

To find the Longitude by Lunar Observation, taking into the Account the Spheroidal Figure of the Earth. (See App. 38, 39.)

(282.) In the foregoing rules for finding the longitude by lunar observation, both refraction and parallax have been supposed to affect the places of the bodies in their respective circles of altitude, elevating or depressing them towards or from the *true* zenith. This supposition is quite correct for refraction (Art. 124), but for parallax it is not strictly correct (Art. 118, &c.). Parallax actually affects a heavenly body's place in a circle, which passes through the straight line drawn to it (independently of refraction) and the radius of the earth (Art. 118): the apparent and true places of the body, parallax only considered, must therefore be in a great circle on the celestial concave, which passes through the earth's radius produced, that is, through the *reduced* zenith, and not through the *true* zenith. Hence it appears, that to compute the true distance from the observed distance, we ought first to correct the latter for refraction, and then the distance resulting from this operation for parallax. Also, if the earth be considered as a spheroid, the hor. par. of the moon will be somewhat less in any considerable latitude than it is at the equator as put down in the Nautical Almanac, inasmuch as the earth's radius in such latitude is less than the equatorial radius. The moon's hor. par. as taken from the Nautical Almanac will require correcting: see Naut. Table (*h*).

(283.) RULE. Get a Greenwich date in mean time, and take every quantity required from the Nautical Almanac as pointed out in Art. 270, &c. Diminish the hor. par. of moon by reduction (see Table *h*), and at the same time take from that table the reduction of latitude. Get app. alti-

tudes, and taking each to nearest 15'' mark it A. A.; get also app. distance A. D., correct each A. A. for refraction only, as if each body were a fixed star; mark each result T. A. Take the difference of the arcs marked A. A., and also of those marked T. A.; under the difference of the A. A.'s put the apparent distance taken to the nearest 15'' (reserving the seconds added or subtracted); take the sum (S.) and difference (D.)

Add together numbers taken from table, Naut. Tables, p. 12* (o 4) for the A. A. of each body as a star, the *halves* of *log. haversines* of (S.) and (D.), rejecting the tens in the index of sum. Take out the arc to the nearest second corresponding to the result as a *log. haversine*, and to the *nat. versine* of this arc add the *nat. versine* of difference of T. A.: the sum will be the *nat. versine* of an arc, which take out, and *add* the reserved seconds in the apparent distance when they have been previously *subtracted*, or *subtract* them when previously *added*. The result will be the first corrected distance, which mark T. D.

Correct the first true altitudes (T. A.) for reduction by rule in note*. Take the results to the nearest 15'' and mark each A'. A'; correct each for hor. parallax alone by rule in note†, and mark each result T'. A'. Take the difference of the A'. A'.s and also that of T'. A'.s. Under the difference of A'. A'.s put the first corrected distance taken to the nearest 15'' (reserving the seconds added or subtracted); take the sum (S.) or difference (D.)

Add together *log. secants* ‡ A'. A'.s and *log. cosines* of T'. A'.s, the *halves* of the *log. haversines* of (S.) and (D.), rejecting the *tens* in the index of sum. Take out the arc to the nearest second corresponding to the result as a *log. haversine*, and to the *nat. versine* of this arc add the *nat. versine* of the difference of T'. A'.s. The sum will be the *nat. versine* of an arc, which take from the table, and *add* thereto the reserved seconds when they have been previously *subtracted* from first corrected distance, and *subtract* them if previously *added*. The result will be the second corrected distance, or true distance required (T'. D').

Ex. Feb. 4, 1835, at 1^h 44^m 40^s.6 Sh. Mean Time found from following altitude of sun (see *Ex.* p. 139) in latitude 50° 48' 9'' N. and longitude by account 1° 6' W., A. A. sun's cr. 20° 2' 46'' bearing S. W. b. S.; A. A. moon's cr. 30° 13' 34'' bearing S. E. $\frac{1}{2}$ S.; *app. dist. of crs.* 76° 48' 10'', equatorial hor. par. of moon 54' 11''.9; reduction of eq. hor. par. — 6''.1; reduction of latitude — 10' 34''; tr. dist. from Naut. Almanac at 0^h, 75° 48' 3'', at III. 77° 8' 56'': required the true longitude.

* With the true bearing of the body (reckoned from S. in north latitude, and from N. in south latitude) as a *course*, and the *reduction* of latitude to sphere (see Table *h*) as a *distance*, enter a traverse table: the corresponding difference of latitude will be the reduction of altitude required. When the said bearing is less than 8 points or 90°, this reduction must be *added*; when it is greater than 8 points or 90°, what it wants of 16 points or 180° must be used, and the reduction in that case *subtracted*. In this operation it must be remembered, that seconds may be turned into tenths of minutes by dividing by 6, and tenths of minutes reduced to seconds by multiplying by 6.

† The correction in parallax is found.—*For the Moon*, by adding refraction as for a fixed star to the correction in altitude taken from Table (*w*). Or it may be computed by adding *log. secant* of A'. A'. to *prop. log.* hor. parallax, rejecting 10 in the index. The result will be the *prop. log.* of parallax as required. *For Sun*, parallax may be taken from Table (*cc*). *For a Planet*, parallax may be taken from Table (*c*). *For a fixed Star*, there is no parallax.

‡ When one of the bodies is a fixed star, the A'. A'. and T'. A'. will be the same, and no notice need be taken of *log. secant* A'. A'. and *log. cos.* T'. A'.

FOR REFRACTION.				FOR PARALLAX.			
Sun's A.	A. 20°	2' 45"	Moon's A. A. 30° 13' 30"	Sun's A. A. 20° 8' 45"	Moon's A. A. 30° 20' 0"	0"	
Refr.	2	39—	1 39—	Par.	8+	46	42+
T. A.	20	0 6	T. A. 30 11 51	T'. A'. 20	8 53	T'. A'. 31	6 42
Reduction	8	42+	Reduction 8 6+				
	20	8 48	30 19 57	20° 8' 45"		0.027417	
			119	30 28 0		9.972576	
			120			0.063937	
	20° 2' 45"		4.837746	10 11 15		9.932556	
	30 13 30		4.739735	76 49 45 (—6")		4.837879	
				(S.) 87 1 0		4.739831	
	10 10 45		9.577720	(D.) 66 38 30		9.574196	
	76 48 15(—5")		75° 54' 3"	Diff. T'. A'. 10° 57' 49"		75° 32' 21"	
			0756385			0750183	
(S.)	86 59 0		14			99	
(D.)	66 37 30		0015753	76 37 0		0018207	
			43	+6		45	
Diff. T. A.	10 11 45			T'. D'. 76 37 6		0768538	
			0772195	Corr. Gr. Feb. 4, 1 ^h 49 ^m 9 ^s .5			
	76 49 56			Sh. Feb. 4, 1 44 40.6			
	5—						
T. D.	76 49 51			4 28.9			
				Long. 1° 7' 13" W.			

To find the Longitude from the Occultation of a Fixed Star by the Moon.

(284.) The moon in its monthly revolutions round the earth, at the distance of about 240 thousand miles, frequently passes between the earth and a fixed star, so as to intercept the spectator's view of the latter. This is called an *occultation* of a fixed star by the moon. From the observation of this, the longitude may be found with greater exactness than by a lunar distance, because the instant of the disappearance or reappearance of the star can be ascertained without the use of any instrument liable to error. The observation itself is easy, and at the same time interesting; the principal difficulty has been supposed to lie in the necessary calculations, which therefore we shall endeavour to make as direct and simple as possible. A single example or two in practice at sea will, beyond doubt, render the method perfectly plain and easy.

Let a star be supposed to appear a little to the east of the moon in the track which the latter body is describing round the earth. Then the moon, as it moves from west to east, will be seen to approach the star, and at length will touch it with the eastern edge or limb. The next moment the star will disappear; which disappearance will be distinct and instantaneous, when the eastern limb of the moon is dark; if it be enlightened, the observation will not be quite so exact, though sufficiently so in general for the purpose of finding the longitude. After a certain interval the moon having passed over the star, the spectator will see the star apparently emerging from the western limb. The observation of this also will be more or less exact, according as the western limb is dark or bright.

The observation may be made frequently with precision at sea by means of a common spy-glass.

In some instances of occultation the centre of the moon will pass over the star, in which case the duration will be the longest; in others a much

larger segment of the moon will pass on one side of the star than on the other, when the duration will be less.

When the observation is made of the disappearance or reappearance of a fixed star, it is necessary at the same instant to determine ship mean time. This may be done by a good common pocket watch with a second hand, the error of which on mean time may be found by taking the altitude of a star bearing nearly east or west, or more accurately the altitudes of two stars, one bearing nearly east and the other nearly west. If the interval between the time altitude and the occultation be considerable, a chronometer should be used, the amount of the rate of which should also be considered, and likewise the run in longitude in the interval, as in the lunar observation. When the altitude of the sun or a bright star cannot be got for this purpose, the altitude of the moon or a planet may be taken, supposing them to be sufficiently far from the meridian.

(285.) The steps in taking the observation are therefore sufficiently obvious. The next thing required is to give a rule for the necessary computation. The principle of such rule is as follows. At the instant of disappearance or reappearance of the star, the apparent right ascension and declination of the point of the moon's limb in contact with the star is the same as the right ascension and declination of the star, which latter we can with great facility and precision take from the Nautical Almanac. Correcting the *apparent* right ascension and declination of the point in question for parallax, we get its true right ascension and declination. Then, considering that the distance of this point from the moon's centre is the semi-diameter of the moon, and that we can get from the Tables the declination of the centre for the assumed Greenwich date, we are enabled to compute from these data the true right ascension of the moon's centre. Lastly, as the true right ascension of the moon's centre is put down in the Nautical Almanac for every Greenwich mean hour, we can from this last result easily compute Greenwich mean time, subject to a small error, which may be removed by repetition, should the assumed Greenwich date be found essentially incorrect.

The ship mean time is known as explained above. Hence therefore we know the longitude.

Occultation of a Fixed Star. (See App. 40.)

(286.) **RULE.** Get a Gr. date as in Art. 185, or as in note thereto.* For this date take from the Nautical Almanac the R. A. mean sun, the R. A. of star (which call *apparent R. A.*), the decl. of star (which call *app. decl.*), the R. A. of moon at hour of Gr. date, the change of R. A. of moon in seconds from that hour to the next hour; the decl. of moon at Gr. date, the hor. semid. in seconds, the hor. par. in seconds, which reduce to latitude (Naut. Tab. (*h*) p. 4), and correct the latitude itself for reduction (Table *h*).

Add together ship mean time expressed astronomically, and the R. A. of mean sun; and from the sum (increased if necessary by 24 hours) sub-

* This date is best got by applying to time shown by chronometer at observation its known error on Gr. mean time. The result of the computation will determine probably a more correct error, which may be used afterwards in finding the longitude by chronometer. From observations of this kind at an interval of several days the rate of chronometer may also be determined.

tract the R. A. of star, and from the remainder (if greater than 24 hours) reject 24 hours. The result, if less than 12 hours, will be the *apparent* hour angle W. ; if greater than 12 hours, subtract the result from 24 hours, and the remainder will be the *apparent* hour angle E.

Write down *log.* of reduced hor. parallax separately under heads marked (1), (2), (3) :

Under (1) put *log. cos.* red. lat. and 8.522879.

Under (3) . *log. cos.* red. lat.

Under (2) . *log. sin.* red. lat.

Under (1) . *log. sin.* app. hour angle.

Add together the four logarithms under (1), rejecting the *tens* in the index of sum ; and mark the sum (*a*),

Under (*a*) . *log. sec.* app. decl.

Under (2) . *log. cos.* app. decl.

Under (3) . *log. sin.* app. decl.

Add together the two last logarithms under (1), rejecting *tens* from index of sum. The result will be the *log.* of a number of seconds, which take from the table and subtract (turned into minutes and seconds) from the app. hour angle.

Under (3) write *log. cos.* corrected hour angle. Add together *logarithms* under (2) and (3), rejecting *tens* in index of each sum. The result under (2) will be *log.* of first part of parallax in declination in seconds, to which (taken from table) give the same name as that of apparent declination when latitude and apparent declination have the *same* name, and a *different* name from that of the apparent declination when the latitude and apparent declination have *different* names. The result under (3) will be the second part of the parallax in declination in seconds, to which (taken from table) give the *same* name as that of the apparent declination when the corrected hour angle is *greater* than 6^h, and a *different* name from that of the apparent declination when the corrected hour angle is *less* than 6^h. When the names of the two parts are *like*, their sum with the *same* name will be the parallax in declination ; when the names of the two parts are *unlike*, their *difference* with the name of the greater will be the parallax in declination. Put the parallax in declination under the apparent declination ; when the names are *like*, their sum with the *same* name will be the corrected declination ; when the names are *unlike*, their *difference* with the name of the greater will be the corrected declination.*

Under a head marked (4) put (*a*) ; 0.301030 ; and *log. sec.* of corrected declination. Add these together, rejecting the tens in the index of sum. The result will be *log.* of parallax in R. A. in seconds of time, which take from the table to the nearest hundredth of seconds. Add it to the apparent R. A. when the observation has been W. of meridian, and subtract it from the apparent R. A. (adding 24^h to the latter, if necessary) when the

* Observe here whether, if the resulting corrected declination were substituted for that used under (1), any material change would be produced in the corrected hour angle, and thereby in the *log. cos.* of this angle under (3). If there should, alter the said *log. cos.*, and then the 2nd part of parallax in decl. and the corrected declination itself.

observation has been to the E. of meridian. The result will be the corrected R. A.

Under the corrected declination put the declination of moon taken from Naut. Alm. for Greenwich date. When the names are *like*, take their *difference*; when their names are *unlike*, take their *sum*. Turn the result into seconds, and under it put the moon's hor. semid. in seconds. Take the sum and difference. Add together the *logarithms* of this sum and difference, the *log. secants* of the two declinations just used, and 7.647818, rejecting tens in index of sum. Take half the result, which will be the *log.* of moon's semid. in R. A. in seconds of time (see App. 41), which take from the table to the nearest hundredth of second, and *add* the result (turned into minutes and seconds) to the corrected R. A. when a *reappearance* has been observed, and *subtract* it from the corrected R. A. (adding if necessary 24^h to the latter), when a *disappearance* has been observed. The result will be the R. A. of moon's centre by observation; under which put the moon's R. A. taken from Naut. Alm. for the *hour* of Greenwich date. Take the difference, which turn into seconds. To the *log.* of these seconds add 3.556302, and then subtract *log.* of change of moon's R.A. from hour of Greenwich date to next hour (see App. 41). The result will be a number of seconds of time, which take from the table to the nearest hundredth; and add them* (turned into minutes and seconds) to the hour of assumed Greenwich date. The result will be a Greenwich date computed from the observation. If this agree with the one assumed, it is correct; if not, assume this computed date as a new Greenwich date, and repeat such parts of the work as may be necessary, till this exact agreement with the *last assumed date* is produced.

In repeating the work, it should be first observed, whether the alteration in the Greenwich date will make any material alteration in R. A. of mean sun, in hour angle, in hor. semid., and in hor. parallax. If it does, the work should be entirely gone through again; but if not, which generally will be the case, it will be sufficient to correct the declination of moon's centre from Naut. Alm. for the change of date, and to repeat the computation of moon's semid. in R. A.; proceeding afterwards as before to get a new Greenwich date; and repeating the same part of computation, till there is an agreement of the resulting date with the assumed, as nearly as may be wished.

The difference between the last resulting Greenwich date and the ship date in mean time will be the longitude in time.

If the time has been taken by chronometer at the instant of the observation, the difference between this and the last resulting Greenwich date will be the error by occultation of the chronometer on Greenwich mean time; which error may be used afterwards in finding longitude by chronometer.

Ex. Feb. 12, 1835, in lat. $50^{\circ} 49' 5''$ N. and longitude by account $1^{\circ} 4' 52''$ W. the beginning of an occultation of γ Cancer at the moon's limb took place (W. of Mer.) at $2^h 29^m 40^s.5$ A. M. ship mean time: required the true longitude.

* If the computed R. A. of moon's centre should be less than the R. A. at hour of Greenwich date, this resulting time must be subtracted from the hour.

Gr. Feb. 11,	14 ^h 34 ^m 0 ^s	R. A. Moon at 14 ^h ,	8 ^h 33 ^m 24 ^s .27
R. A. Mean Sun	21 25 42.61	Change in 1 ^h ,	145 ^s .04
Apparent R. A.	8 33 44.21	Hor. Semid.,	946 ^{''} .6
Apparent Decl.	22° 3' 25 ^{''} .8 N.	Red. Hor. Par.	3467 ^{''} .6
Apparent Hour Angle	3 ^h 21 ^m 38 ^s .9 W.	Decl. Moon at Gr. date 22° 42' 59 ^{''} .1 N	
		Red Lat. Ship	50 38 30 N.

(1.)	(2.)	(3.)	(4.)
3.540029	3.540029	3.540029	1.751971 (a)
9.802205	9.888289	9.802205	0.301030
8.522879	9.966991	9.574655	10.034700
9.886858		9.806633	
	3.395309		2.087701
1.751971 (a)	2484 ^{''} .9 N.	2.723522	122 ^{''} .38
10.033009	529.1 S.		
			2 ^m 2 ^s .38+
1.784980	1955.8 N.		8 33 44.21
1 ^m 0 ^s .9—			
3 21 38.9	32' 35 ^{''} .8 N.		8 35 46.59
	22 3 25 .8 N.		1 1 .37—
Corr. H. Ang. 3 20 38			
	22 36 1.6 N.		8 34 45.22
	22 42 59.1 N.		8 33 24.27
		*3.134846	
	6 57.5	2.723538	80.95
		10.034700	1.908217
	417.5	10.035069	3.556302
	946.6	7.647818	
			5.464519
	1364.1*	3.575971	2.161487
	529.1		
		1.787985	3.303032
			2009 ^s .24
			61 ^{''} .37 Gr. Feb. 11, 14 ^h 33 ^m 29 ^s .24

(287.) After computing the corrected declination 22° 36' 1^{''}.6 N. as above, it may be easily seen, that by using this in getting the second sum under (1), there would not be occasioned any material alteration in the corrected hour angle, and consequently none in the second part of parallax in declination. It appears that the resulting Greenwich date 14^h 33^m 29^s.24 is less than the first assumed one by 30^s.76: the corresponding declination of moon's centre will therefore, at the rate 66^{''}.22 in 10^m (see Nautical Almanac), be less than for the first assumed date by 3^{''}.4, or it is 22° 42' 55^{''}.7 N., and the difference of declination becomes 6' 54^{''}.1 or 414^{''}.1. Proceeding with this exactly as before in the above computations, the moon's semid. in R. A. instead of 1^m 1^s.37 comes out 1^m 1^s.49, the corrected R. A. of moon's centre is 8^h 34^m 45^s.10, and the difference of this from R. A. at 14^h is 80^s.83, which gives an interval of time from 14^h of 2006^s.26 or 33^m 26^s.26. The new Greenwich date is therefore 14^h 33^m 26^s.26. Assuming this as a third Greenwich date, the change of declination of moon's centre is 0^{''}.3, new declination 22° 42' 55^{''}.4 N., and difference of declination is 413^{''}.8. The moon's semidiameter in R.A. becomes 1^m 1^s.50, and the corrected R. A. of moon's centre 8^h 33^m 45^s.09. This is greater than the moon's R. A. at 14^h by 80^s.82, which gives in interval 34^m 26^s.01. The new Greenwich date is therefore 14^h 33^m 26^s.01, which, being so near the last, may be considered as the correct Greenwich date. Taking the difference between this and the ship mean time 14^h 29^m 40^s.5, the true longitude comes out 0° 56' 22.6^{''} W.

(288.) The foregoing rule for computing the longitude from an occultation of a fixed star by the moon is perhaps as easy and direct as the nature

of the subject allows of; and is certainly quite within the reach of seamen who are accustomed to the use of logarithms. In order to be prepared for the occultation of a fixed star, the seaman may consult the tables given for the purpose in the Nautical Almanac, especially the one headed "Elements for facilitating the Computation of Occultations," &c. He will find it both interesting and useful also, from time to time, to examine with his spy-glass that part of the celestial concave which lies immediately to the eastward of the moon; and when he sees any star there likely to be occultated by the moon, to find from the table in the Nautical Almanac already referred to the name of the star, and the further probability of an occultation's really taking place.

(289.) After the disappearance of the star (should it be really occultated), it may be of consequence to be able to fix on the point nearly on the western limb of the moon, where it will reappear, in order that the observer may direct his glass to that point, and see the star at the instant of its appearance from behind the moon. This may be done in general as follows: estimate by the eye the point on the moon's limb, where a diameter drawn tending to the elevated pole of the heavens cuts it, and call this the north or south point; and having sketched a circle and the diameter for a representation, draw a chord on the circle from the estimated point of disappearance perpendicular to the said diameter. From the further extremity of this chord draw a perpendicular to the chord opposite to the direction of moon's motion in declination, and having ascertained from the Nautical Almanac the proportion of the change of moon's declination in 10^m (as d) to that of the moon's R. A. (turned into arc) in 10^m (as a), take the perpendicular in the same proportion to the chord that d has to a , that is, as nearly as can be estimated by the eye. From the point of disappearance draw a line to the extremity of perpendicular. This line (produced if necessary) will indicate on the circumference of circle, and thereby on moon's limb, the point of reappearance nearly.

To find the Longitude from an Eclipse of the Sun. (See App. 42.)

(290.) The cause of an eclipse of the sun is the same as that of an occultation of a fixed star. The moon, in passing between the earth and the sun, intercepts the solar light, and to a spectator on the earth the sun appears darkened on its surface. The observation of the beginning or end of the eclipse is noted without any difficulty, the point where the observation begins being supposed to be nearly known. The rule for finding the longitude is similar to the one just given for the occultation of a fixed star. Suppose the semidiameter of the moon passing through the point where the sun and moon are apparently in contact to be produced visibly to the centre of the sun as seen by the observer, and let this centre be first supposed at the distance of a fixed star so as to have no parallax. Then it is manifest that the rule given for an occultation must apply here, substituting for the moon's semidiameter the sun and moon's semidiameters, the former being considered as at the distance of the moon seen from the earth's centre, that is, the augmentation of this semidiameter, as if it were the moon's, being subtracted from the sun's semidiameter taken out of the Nautical Almanac (see App. 42). The sun's centre has been supposed to have no parallax; but in fact it has a horizontal parallax of about $8''.7$. Hence in finding the apparent place as seen by the observer, we cannot proceed

exactly as for a fixed star, whose place as seen from the earth's centre is the same as when seen from the surface, and therefore may be taken at once from the tables. We must take the sun's right ascension and declination from the Nautical Almanac; and, to get the apparent right ascension and declination, we should correct for parallax; which being done, we should have reduced the question to a perfect similarity, as above explained, with the case of an occultation. The next step therefore would be to re-correct the apparent right ascension and declination of the sun's centre, using the horizontal parallax of the moon in this computation. This would evidently give the same true place as if, taking the right ascension and declination of the sun's centre from the Nautical Almanac, we consider these elements as apparent, and correct them for parallax; using, instead of the moon's horizontal parallax, the difference between the horizontal parallax of the sun and moon (see App. 42).

Thus we get the true right ascension of the point answering the sun's centre, and thence, as in the rule (Art. 286), the true right ascension of the moon's centre, from which Greenwich mean time is deduced.

Mean time at the ship is found by means of a chronometer, whose error has been determined from the altitudes of heavenly bodies, taken if possible both east and west of the meridian.

Longitude by Solar Eclipse.

(291.) RULE.—From ship mean time and the longitude by account, or from the chronometer, get a Greenwich date. For this date take from the Nautical Almanac the R. A. and decl. of the sun, which call *app. R. A.* and *app. decl.* Take out also R. A. of mean sun, sun's semid. (which diminish by augmentation as if it were the moon's semid.), the sun's hor. par., the moon's hor. par. (which diminish by reduction), the moon's R. A. at hour of Greenwich date, the change of moon's R. A. in 1^h. Proceed then as in rule for occultation of fixed star, using for semid. the sum of semi-diameters (the sun's being diminished by augm.), the difference of reduced hor. par. of moon and hor. par. of sun for hor. par. of moon, and the R. A. and decl. of sun for those of star.

Ex. May 15, 1836, in latitude 53° 22' 38" N. and longitude by account 6° 40' 22" W. the end of a solar eclipse was observed at 4^h 7^m 23^s.5 P. M. mean time, the altitude* of the sun being about 37°: required the true longitude. A chronometer at the instant of the observation showed 4^h 30^m 25^s.5; required its error on Greenwich mean time.

Gr. May 15,	4 ^h 34 ^m 5 ^s	R. A. Moon at 4 ^h ,	3 ^h 32 ^m 43 ^s .62
R. A. Mean Sun	3 33 43.00	Change in 1 ^h ,	120 ^s .98
R. A. True Sun	} 3 29 47.11	Moon's Hor. Semid.	} 1829 ^s .1
or app. R. A.		+ (Sun Semid.—Augm.)	
Decl. True Sun	} 18° 59' 15" N.	Moon's Red. Hor. Par.	} 3247 ^s .6
or App. Decl.		— Sun's Hor. Par.	
Hour Angle	4 ^h 11 ^m 19 ^s .39	Moon's Decl. at Gr. date	19° 47' 0 ^s .2 N.
		Red Latitude	53 12 15 N.

* The altitude of the sun may be observed with a sextant, or it may be ascertained nearly by adjusting a celestial globe to the time. It should be known nearly for the purpose of finding supposed augmentation from Naut. Tab. (g), p. 4.

	(1.)	(2.)	(3.)	(4.)
	3.511562	3.511562	3.511562	1.761068 (a)
	9.777402	9.903510	9.777402	0.301030
	8.522879	9.975703	9.512367	10.025895
	9.949225		9.663336	
		3.390775		2.087993
	1.761068 (a)	2459".09 N.	2.464667	122'.46
	10.024297	291.52 S.		
	1.785365	2167.57 N.		+2 ^m 2 ^s .46
		36' 7".6 N.		3 29 47.11
	1 ^m 1 ^s	18 59 15.0 N.		3 31 49.57
	4 11 19.4			+1 59.72
		19 35 22.6 N.		
Cor. H. }		19 47 0.2 N.		3 33 49.29
Angle }	4 10 18.4		*3.402553	3.32 43.62
		11 37.6	3.053654	
		or 697".6	10.025895	1 5.67
		1829.1	10.026420	
			7.647818	65.67
		2526.7*		
		1131.5	4.156340	1.817367
				3.556302
			2.078170	
			119 ^s .72	5.373669
				2.082714
			1 ^m 59 ^s .72	3.290955
				1954 ^s .14
				Gr. May 15, 4 ^h 32 ^m 34 ^s .14

Taking Gr. May 15, 4^h 32^m 34^s.14 as a new Greenwich date, the moon's decl. is 19° 46' 45".4 N. the R. A. sun or app. R. A. is 3^h 29^m 46^s.86, and decl. of sun or app. decl. is 18° 59' 14".1 N.; no material change will be made in the hor. par., semid. and hour angle, or in the correction of declination. Hence the corrected declination will be 18° 59' 14".1 + 36' 7".6 or 19° 35' 21".7 N.

		h m s	
19° 35' 21".7 N.	*3.400158	3 29 46.86	1.818358
19 46 45.4 N.	3.058957	+ 2 2.46	3.556302
	10.025895		
11 23.7	10.026409	3 31 49.32	5.374660
	7.647818	2 0.12	2.082714
683.7			
1829.1	4.159237	3 33 49.44	3.291946
		3 32 43.62	1958 ^s .6
2512".8*	2.079618		Gr. May 15, 4 ^h 32 ^m 38 ^s .6
1145.4	120 ^s .12	65".85	

By the above repetition of part of the work the computed Greenwich date comes out 4^h 32^m 38^s.6, and by a second repetition in a similar manner it comes out 4^h 32^m 38^s.3, which may be considered as correct. The true longitude is therefore 6° 18' 42" W., and the error of the chronometer (which showed 4^h 30^m 25^s.5 at observation) on Greenwich mean time is 2^m 12^s.8 *slow*.

To find the Longitude from the Occultation of a Planet by the Moon.
(See App. 42.)

(292.) An occultation of a planet by the moon is in appearance similar to that of a fixed star, with the exception that a planet having a semidiameter of sensible length, does not (like a star) pass wholly behind the moon's limb or emerge from it wholly, in an instant. In this respect such an occultation partakes of the nature of a solar eclipse, in which, by the interposition of the moon, the sun's disk is gradually darkened or lost sight of. In a planetary occultation it is necessary therefore to take into account the semidiameter of the planet, by making the observation at the moment of an external contact of the moon and planet, or at the moment of their internal contact. It is more convenient in general to do the latter (if possible) since at an immersion the planet then wholly disappears, and at an emersion it is first seen. When the observer is furnished with a telescope of sufficient power, he may often take the times of both the external and internal contacts of the bodies.

At the instant of the total disappearance or first appearance of the planet the distance of its centre from the moon must be the *difference* between the apparent semidiameters of the moon and planet; seen from the centre of the earth it would be the difference between the hor. semidiameters of the two bodies, on the supposition that the planet is at the same distance from the earth as the moon; supposing also that the whole disk of a planet is enlightened, which may be considered as true in every case except for Venus. This difference therefore may be substituted in the application of the rule, Art. 286, instead of the moon's hor. semidiameter alone. The same substitution may be also made at the total disappearance of Venus, when the moon is approaching the sun, and at its first reappearance when the moon is receding from the sun. When an external contact is observed, the *sum* of the semidiameters must be used. When both the external and internal contacts are observed the mean of the times will be the time of the contact of the planet's centre, in which case there will be no occasion to take into the account the planet's semidiameter.

The augmentation of the planet's semidiameter seen at the moon's distance, being very small, may be neglected. It is the same part of the augmentation of the moon's semidiameter that the planet's semidiameter is of the moon's.

The difference of the moon's reduced hor. parallax and that of a planet must be used for the moon's alone. The planet's R. A. and declination, semidiameters and horizontal parallax, may be taken from the Nautical Almanac.

To find the Longitude by the Transit of the Moon's enlightened Limb over the Meridian. (See App. 43.)

(293.) When a transit telescope (see articles on instruments) is placed in the meridian, the longitude may be found by noting the time shown by a chronometer, when the enlightened limb of the moon passes the middle or meridian wire, the error of the chronometer on mean time at the place being supposed known.

By applying the error of the chronometer to the time shown by it at observation mean time at the place is known. From this and the longitude by account get a Greenwich date, and for this date take from the Nautical Almanac the R. A. of mean sun, the hor. semidiameter of the moon,

and its declination: take out also the moon's R. A. for hour of Greenwich date, and the change of R. A. from that hour to the next.

To the *logarithm* of the moon's semidiameter in seconds add the *log. secant* of the moon's declination, and the number 8.823909, rejecting the tens from the index in the sum. The result will be the *logarithm* of the moon's semidiameter in R. A. in time, which take out to the nearest hundredth of second, and express in minutes and seconds. Add together the mean time at place and the R. A. of mean sun; the sum diminished by 24^h if greater than 24^h , will be sidereal time (or R. A. of moon's enlightened limb). To this, when the *western* limb is observed, *add* the semidiameter in R. A., rejecting 24^h if the sum be greater than 24^h ; and when the *eastern* limb is observed, *subtract* from the sidereal time (adding 24^h if necessary) the moon's semidiameter in R. A. The result will be the R. A. of the moon's centre from observation.

Under this put the moon's R. A. for hour of Greenwich date, and take the difference. To the *logarithm* of this difference in seconds add number 3.556302, and from the sum subtract *logarithm* of change of moon's R. A. in one hour. The result will be the logarithm of a number of seconds, which take out to nearest hundredth of second, and, expressing it in minutes and seconds, add* the result to the hour of the Greenwich date. The result will be the Greenwich date from observation. If this agree exactly with the assumed Greenwich date, it is correct: if not, assume it as a new Greenwich date and repeat the computation till as exact an agreement between the result and the last assumed Greenwich date takes place as is required. From this result and M. T. at place find the longitude.

Ex. April 10, 1835, in latitude $50^\circ 48' N.$, and longitude by account $8^\circ 45' 54'' W.$, the enlightened western limb of the moon passed the meridian at $10^h 6^m 44^s$ mean time: required the true longitude.

Sh. April 10, $10^h 6^m 44^s$	2.991115	R. A. M. Sun $1^h 13^m 44^s.60$
Long. in T. 0 35 3.6 W.	10.006210	Mean T. 10 6 44
	8.823909	
Gr. April 10, 10 41 47.6		Sid. Time 11 20 28.60
	1.821234	As before 1 6.26
Moon's Hor. Sem. $979''.75$	$1^m 6^s.26$	
Decl. $9^\circ 39' 55'' N.$	11 20 28 .57	11 21 34.86
R. A. Mean Sun $1^h 13^m 44^s.57$		11 20 0.55
Mean Time 10 6 44	11 21 34 .83	
	11 20 0 .55	94 ^s .31
Sid. Time 11 20 28.57		
Moon's R. A. at $10^h 11$	94 ^s .28	
Change in 1^h 134 ^s .72		
	1.974420	1.974558
	3.556302	3.556302
	5.530722	5.530860
	2.129433	2.129433
	3.401289	3.401427
	2519.35 <i>secd.</i>	2520.16 <i>secd.</i>
Gr. April 10, $10^h 41^m 59^s.35$	. . .	$10^h 42^m 0^s.16$

* Subtract if R. A. from observation be less than that at hour of Gr. date.

From a second repetition results $10^h 42^m 0^s.1$, which may be considered as the correct Greenwich date. Taking the difference between this and the Sh. mean time, the true longitude is got, namely, $8^\circ 49' 1''.5$ W.

(294.) When the error of the chronometer on *sidereal time* is known, in that case sidereal time used in the computation is known without taking from the Nautical Almanac the R. A. of mean sun. The other elements, however, must be taken out for a Gr. date in mean time got as nearly as possible. It is best to determine the error of chronometer on sidereal time by observing transits of stars near the moon having nearly the same declination, which may be found in the Nautical Almanac under the name of *moon culminating stars*. By this means any small error in the position of the transit telescope will be corrected. (See *App. 44.*)

(295.) In closing the subject of finding the longitude by the four methods above, it may be observed that perfect exactness cannot be arrived at, on account of slight errors in the observation, and also on account of the errors in the tables of the moon's place. Those last, however, are now very small, and can be of no consequence in a practical point of view.

If the same occultation, eclipse, or transit of the moon should be observed at two different places, the errors of the tables would produce the same error in the longitude of each place, and the difference of longitude would on this account have no error. If one of the places be Greenwich, or a place whose longitude has been exactly ascertained, we should thus get the longitude of the other place so far correctly. If the observations were made with similar telescopes and equal care, it might be expected that the slight unavoidable errors of observation would also in a great degree correct one another in the result. This last remark may be extended to the method of determining the longitude by the eclipses of Jupiter's satellites, of which we shall now give a short explanation.

To find the Longitude by an Immersion or Emersion of Jupiter's Satellites.

(296.) The satellites of Jupiter describe orbits round that body in the same manner as the moon does round the earth, and they are occasionally deprived of the solar light. An eclipse of the moon is caused by the interposition of the earth between it and the sun; and the eclipse of a satellite of Jupiter is caused by being in a similar manner carried, with respect to the sun, behind the planet. This deprivation of light may frequently be seen from the earth; and as it occurs at the same instant on every part of the earth, the observation furnishes a very ready and exact method of finding the difference of longitude between two places, by simply taking the difference of times at the places when the observation is made. Moreover, the Greenwich mean times of the eclipses of the satellites, which can be seen, are computed and put down in the Nautical Almanac; whereby the observer is enabled to determine his longitude at once, by taking the difference between the Greenwich time and the time at the place.

(297.) Before the earth, by its annual motion from west to east, is brought between the sun and Jupiter, the shadow of the planet being thrown behind the planet and opposite to the sun, must be seen from the earth to the west of Jupiter. And hence all eclipses of the satellites, which happen then, must be seen to the west of the planet. For a similar reason after

the earth has passed between the sun and planet the shadow must lie apparently on the east of Jupiter, and the eclipses of its satellites must also be seen to the east. When a satellite, in moving round Jupiter from west to east, passes into the shadow, it is called an *immersion*; after this the satellite is for some time invisible, and then passes out of the shadow, which is called an *emersion*. Both the immersions and emersions of the satellites farthest from Jupiter (the 3rd and 4th) are frequently visible, and sometimes those of the next (the 2nd). Both these are never seen of the nearest to Jupiter the (1st); since one side of the shadow which lies near the planet is, with respect to the earth, behind the body of the planet.

When an eclipse of one of the satellites is expected, the first thing is, from the Greenwich time of the immersion or emersion put down in the Nautical Almanac and the estimated longitude, to get a date in M. T. at the place, adding east longitude and subtracting west. This will be the time very nearly when the observation must be taken. The observer should therefore be fixed at his telescope a minute or two before his watch or chronometer indicates this time; with the axis of the telescope pointed precisely to the satellite, if an immersion is about to take place, and precisely to the point where the satellite will appear, when an emersion is about to take place. This point of immersion or emersion may be known from the Nautical Almanac.

When the observer is seated at his telescope, and has fixed his eye on the proper point, he must keep that point carefully in the middle of the field of view, till the observation is complete. At an immersion, he watches the satellite till it disappears, at which instant the time is taken by a chronometer, whose error is known on mean time at the place. At an emersion, he watches the point of appearance, till he thinks he perceives the satellite, at which instant the time is taken; still, however, he keeps his eye on the spot till either assured that he has not been deceived, or till he again thinks he sees the satellite. The difference between mean time at the place so determined and Greenwich mean time taken from the Nautical Almanac is the longitude in time.

(298.) The observer must attend to the following directions. His telescope must have the sufficient magnifying power, and yet not so much as to cause too great a loss of light. The most convenient kind of telescope is an achromatic one of about 46 inches in length, and $2\frac{3}{4}$ inches aperture. He must seat himself at the telescope in the most easy and steady position; the stand of the telescope must be quite immovable by any slight cause, and his assistant must be placed near with the chronometer, to note the second and portion of a second. Before the observation he must abstain from using the eye much, especially in looking through the telescope, or where there is much light.

The Longitude by an Eclipse of the Moon.

(299.) The moon in describing its orbit round the earth is sometimes deprived of the solar light by the interposition of the earth. The moon is then, with respect to the sun, behind the earth, and is seen from the earth in the opposite point of the celestial concave with a full orb. The beginning and end of the eclipse really happen at the same instant everywhere on the earth, where the moon is visible; and so far would furnish a very easy method of determining the longitude. This method, however, is

of very little practical use, on account of the great difficulty there is in ascertaining at what instant the beginning and end take place, since the moon in passing behind the earth is deprived of the solar light gradually in the former case and is restored to it in like manner in the other. The uncertainty may amount to several minutes.

The longitude therefore, which is hence deduced by taking the difference between the ship time and Greenwich time (as given in the Nautical Almanac) cannot be depended on; and it is unnecessary to give here any any particular rule or example.

Variation of the Compass.

(300.) The needle, when it has been touched by the magnet, does not in general point to the true north, but to east or west of the true north. This deviation is called the *Variation of the Compass*.

The amount of this variation is found by taking the compass bearing of an object, whose true bearing is either known, or can be computed. The difference of the two bearings is the variation required. Thus let the true bearing of a place A be N. E., and its compass bearing E. N. E.; then the variation is 2 points. Again, let the true bearing of an object B be N. $45^{\circ} 10'$ W., and its compass bearing N. $37^{\circ} 50'$ W.; then the variation of the compass is $7^{\circ} 20'$. When the north end of the needle is turned to the east of the true north, the variation is called *east*; and when it is turned to the west thereof, the variation is *west*. Let the variation be two points east; then the north end of the needle must point to the true N.N.E.; that is, if the compass bearing of an object be N., its true bearing is N.N.E., or the true bearing is two points to the right of the compass bearing. This will manifestly be the case with any other object round the compass. Hence therefore if, of two bearings, the true one is to the right of the other, the observer being supposed to face these points, the variation must be east; and in a similar manner it appears that the variation is west, when the true bearing is to the left of the compass bearing.*

Examples.

Bearing by Compass.	True Bearing.	Variation.
N. E. b. E.	E. b. N.	2 pts. E.
S. S. W. $\frac{1}{2}$ W.	S. $\frac{1}{4}$ W.	$2\frac{1}{2}$ pts. W.
N. $\frac{3}{4}$ W.	N. b. E. $\frac{1}{4}$ E.	2 pts. E.
N. $50^{\circ} 20'$ W.	N. $60^{\circ} 32'$ W.	$10^{\circ} 12'$ W.
S. $110^{\circ} 30'$ E.	S. $92^{\circ} 16'$ E.	$18^{\circ} 14'$ E.
W. $10^{\circ} 15'$ N.	W. $20^{\circ} 40'$ N.	$10^{\circ} 25'$ E.
W. $5^{\circ} 20'$ S.	W. $17^{\circ} 36'$ N.	$22^{\circ} 56'$ E.

(301.) When the compass bearing and true bearing are reckoned from different points of the compass, it is necessary to reduce them to the same, before the variation can be found. This is done by subtracting the compass bearing from 90° or 180° , or by adding thereto 90° , according to circumstances.

* This rule may be recollected by considering, that *east* variation, in correcting compass courses, is allowed to the right, and *west* variation to the left. (See Art. 31.)

Examples.

Compass Bearing.	True Bearing.	Variation.
E. 10° 16' N.	N. 72° 25' E.	7° 19' W.
S. 50° 45' W.	N. 130° 16' W.	1° 1' W.
E. 17° 51' N.	S. 98° 36' E.	9° 15' E.

(302.) The objects, which are usually observed at sea for the purpose of finding the variation of the compass are the heavenly bodies, of which the true bearing can always be computed from the altitude, supposed to be observed at the same time with the bearing. The declination of the body is known from the Nautical Almanac; and the latitude of the ship is known by bringing up the last latitude by observation to the time when the bearing is taken, by means of the log account.

Method of Observing the Compass Bearing at Sea.

(303.) For the purpose of taking the magnetic bearing with accuracy mariner's compasses are constructed with a view to this particular observation. The box, in which the card is placed, is constructed so as to turn horizontally on a central axis, and to carry with it an index fixed to the side, which index may at any time be brought close to the card, and the distance from the north or south point read off. It is fixed in jimbols, in such a manner as to keep the top of the box nearly horizontal, and to ease the violence of any shock. A bar of brass is fitted diametrically over the box, supporting at each end a thin slip of brass; one of these vertical slips is slit lengthwise, and in the other an open space is left in the middle, which is bisected by a fine thread passing from the top to the bottom. The thread and the slit opposite are so adjusted, that a plane passing through them passes also through the centre of the compass and through the edge of the card 90° from the index. A compass so constructed is called an azimuth-compass.

In making an observation with this instrument the eye is placed at the slit, and the box is turned round till the thread is seen to bisect the object; the index is then pushed close to the card and the bearing is read off, allowing for the 90° which the index is to the right.

In taking the compass bearing of the sun, a piece of dark glass is used before the eye; but, in this case, the observation may be made with greater accuracy and expedition, by throwing the shadow of the thread on the diametrical bar of brass, so as to coincide with a groove running along the middle of it. To render the shadow more distinct, the upper surface of this bar may be whitened, or a piece of white paper pasted on part of it. After taking one bearing in this manner, the compass may be turned half round, and the streak of light passing through the slit thrown on the groove in the bar; in which case the opposite point to that shown by the index should be read off.

An observation of this kind for finding the variation is made at sea in the most complete manner by three persons, one of whom turns the box, and throws the shadow on the middle groove; a second keeps his eye fixed at the same time on the index, so as to be always prepared to read off the bearing; and the third takes the sun's altitude with Hadley's sextant. A single person, in observing both the sun's altitude and bearing, should take

the former both before and after the latter, at times as nearly as he can equidistant from it. A mean of the altitudes so taken will then be nearly the altitude corresponding to the bearing. It would add to the accuracy of the result, if five or six observations were taken in succession; especially when it can be done without stopping the card in order to read off. The less the altitude of the sun, when the above observation is made, the better, since any error that may be produced by the uncertainty of refraction near the horizon is small, compared with the errors arising from the imperfection of the instrument and the motion of the ship at a greater altitude. The altitude should never be greater than 15° .

The reading off on the azimuth-compass, in taking the bearing of the sun, should be always reckoned from, or reduced to, the N. or S., according as the latitude is N. or S.

Rule for finding the Variation of the Compass from the Compass Bearing of a Heavenly Body, and its Observed Altitude. (See Apps. 45, 46, 47.)

(304.) Get a Gr. date as in Art. 185, or as in note thereto. For this date take from the Nautical Almanac the declination of the heavenly body, get the polar distance* (P. D.), and whatever is necessary for correcting the observed altitude and finding the true altitude (see Art. 211). Correct the observed altitude and get the true altitude (T. A.).

Under the true altitude put the latitude and take the difference, under which put the polar distance (P. D.), and take the sum and difference. To the *log. secants* of the two first terms in this form (rejecting ten from each index) add the *halves* of the *log. haversines* of the two last. The sum will be *log. haversine* of the true bearing or azimuth reckoned from the N. in north latitude, and from the S. in south latitude, and towards the W. or E. according as the body is west or east of the meridian.

If necessary reduce the compass bearing to the same names N. or S., and W. or E., as the true, by subtracting it from 90° or 180° , or by adding 90° ; and thus reduced (if necessary) put it under the true bearing. Take the difference, which will be the variation, W. when the true bearing is to the left of compass bearing, and E. when the true bearing is to the right of compass bearing.

Ex. 1. Oct. 10, 1835, at $4^{\text{h}} 10^{\text{m}}$ P. M. mean time nearly, in latitude $48^{\circ} 20' \text{ N.}$, and longitude $72^{\circ} 16' \text{ W.}$, the compass bearing of the sun was $\text{S. } 50^{\circ} 25' \text{ W.}$, and the observed altitude of the L. L. was $15^{\circ} 40' 30''$; the index correction was $+2' 10''$, and the height of the eye above the sea was 20 feet: required the variation of the compass.

Ex. 2. Oct. 20, 1835, at $8^{\text{h}} 40^{\text{m}}$ A. M. mean time nearly, in latitude $30^{\circ} 17' \text{ S.}$, and longitude $155^{\circ} 20' \text{ W.}$, the compass bearing of the sun was $\text{N. } 82^{\circ} 25' \text{ E.}$, and the observed altitude of the L. L. was $18^{\circ} 30' 55''$; the index correction was $+5' 20''$, and the height of the eye above the sea was 25 feet: required the variation of the compass.

* When lat. and decl. have the same name, subtract the decl. from 90° ; when lat. and decl. have different names, add the decl. to 90°

(1.) Sh. October 10, 4 ^h 10 ^m			(2.) Sh. Oct. 19, 20 ^h 40 ^m		
Long. in T. 4 49 W.			Long. in T. 10 21 W.		
Gr. October 10, 8 59			Gr. Oct. 20, 7 1		
Sun's P. D. 96° 37' 12"			Sun's P. D. 79° 42' 11"		
T. A. 15 51 6			T. A. 18 44 44		
Compass Bearing N. 129 35 0 W.			Semid. 16 6		
Semid. 16 3					
Lat 48° 20' 0" N.			Lat. 30° 17' 0" S.		
T. A. 15 51 6			T. A. 18 44 44		
32 28 54			11 32 16		
P. D. 96 37 12			P. D. 79 42 11		
129 6 6			9.874887		
64 8 18			N. 119° 57' 30" W.		
			91 14 27		
			N. 129 35 0 W.		
			68 9 55		
Var. 9 37 30 E.			9.699018		
			S. 88° 59' E.		
			S. 97 35 E.		
			Var. 8 45 E.		

(305.) When the sun is rising or setting, and its true altitude is nothing, its L. L. appears about a semidiameter of the sun above the horizon through the effect of refraction. When this is the case, the compass bearing of the sun may be taken, and the same rule applied for calculating the true bearing; putting the true altitude 0° 0' 0": or a more easy rule may be given as follows:—

Rule for finding the Amplitude of a Heavenly Body at Rising or Setting.
(See App. 48.)

(306.) From ship mean time and the longitude find a Greenwich date, for which take from the Nautical Almanac the declination of the heavenly body, to the *log. sin.* of which declination add the *log. sec.* of the latitude, rejecting the tens in the index of sum. The result will be the *log. sin.* of the amplitude of the body, reckoned *from* the E. when it is rising, and *from* the W. when it is setting, and towards the N. or S. according as the declination is N. or S. Under this put the compass amplitude* of the body. When the names are like take the difference, when unlike take the sum. The result will be the variation, W. when the true bearing is to the *left* of the compass bearing, and E. when the true bearing is to the *right* of the compass bearing (see note, Art. 300).

Ex. 1. Oct. 13, 1835, at 5^h 30^m P.M. mean time nearly, in latitude 49° 10' N., and longitude 50° 20' W., the sun's amplitude at setting was *by compass* W. 32° 16' S: required the variation.

Ex. 2. Aug. 24, 1835, at 5^h 30^m A.M. mean time nearly, in latitude 50° 48' N., and longitude 150° 36' E., the sun's amplitude at rising was *by compass* E. 12° 40' S: required the variation.

(1.)			(2.)		
Sh. Oct. 13 . . 5 ^h 30 ^m			Sh. Aug. 23 . . 17 ^h 30 ^m		
Long. in T. . . 3 21 W.			Long. in T. . . 10 2 E.		
Gr. Oct. 13 . . 8 51			Gr. Aug. 23 . . 7 28		
Sun's Decl. . . 7° 45' 0" S.			Sun's Decl. . . 11° 31' 17" N.		

* The compass bearing is supposed to have been read off from the W. or E

9.129854	9.300431
10.184515	10.199263
<hr/>	
9.314369	9.499694
W 11° 54' 0" S.	E 18° 25' 15" N.
W 32 16 0 S.	E 12 40 0 S.
<hr/>	
Var. 20 22 E.	Var. 31 5 15 W.

In the above rule, the true altitude of the sun's centre is supposed to be 0, or its true zenith distance 90° . When this is the case, the apparent altitude of the sun's centre must be nearly $0^\circ 34'$; since it is raised so much by the effect of refraction, while parallax, which on the other hand depresses it, is inconsiderable.

The proper time therefore for taking the amplitude of the sun by the compass at sea is when its centre appears to be raised above the horizon about $34'$, that is, a space equal to the diameter of the sun; or, what may be a better direction, when its lower edge appears to be half way between the horizon and centre.

If a fixed star or a planet be observed, its bearing must be taken when it appears about $34'$, or half a degree above the horizon, or an app. diameter of the sun.

With respect to the moon, the effect of horizontal parallax is to depress it about two of its diameters, whilst refraction raises it only one. This body therefore cannot be seen, when it is truly 90° from the zenith, or its true altitude 0. In this case the bearing should be taken, as soon as sufficient of the moon's disk is perceptible to allow of its being bisected by the thread of the azimuth-compass. This will be quite correct enough for all the purposes for which the variation is wanted at sea.

The amplitude of the sun at rising and setting, and also the time at which it rises or sets, may be taken by inspection from a table constructed for that purpose (see Nautical Tables, p. 373). It is entered with the declination at the top, and the latitude at the side. Under the declination are two columns; one of which contains the amplitude, which is to be reckoned from the W. or E.: the other contains the hours and minutes which the sun rises before or after six o'clock *apparent* time; before, when the latitude and declination have like names, and after, when they have different names: those hours and minutes are also the time, which the sun sets after or before six in the evening; after, when the declination and latitude have like names, and before, when they have different names.

Ex. Let it be required to find from the table at what time the sun rises on Oct. 11, 1835, in latitude 50° N. and longitude 60° W. and its amplitude at rising.

The sun's declination at the nearest Greenwich noon is $6^\circ 51'$ S. Entering the table with a declination 7° and latitude 50° , we have the time $0^h 34^m$, and the amplitude $10^\circ 56'$: that is, the sun rises nearly at 34^m after 6, or at $6^h 34^m$ A.M., and its amplitude is nearly E. $10^\circ 56'$ S. If the time of rising and amplitude be wanted with greater exactness, the declination must be taken out for a Greenwich date got from the approximate ship time and the longitude; and a proportion must be made for the minutes of latitude and declination.

To determine the Bearing of an object by observing the Distance of a Heavenly Body from it. (See App. 49.)

(307.) Suppose an object to be well defined and on a level with the eye. With a sextant bring the image of the heavenly body up to the object; *for the sun*, make the nearest limb touch the object; *for the moon*, make the enlightened limb touch the object; *for a star or planet*, make the image pass through the object. At the same instant let the altitude of the body be observed. By applying the index correction and semidiameter of the body, if it be the sun or moon, to the observed distance as in a lunar observation, get the *apparent distance*, and by correcting the observed altitude for index correction, dip, semidiameter (for sun or moon), get the apparent altitude of centre (A. A.). Under the apparent distance (A. D.) put the apparent altitude (A. A.), and take the sum and difference. To the *log. secant* of app. altitude (A. A.), rejecting ten from the index, add the *halves* of the *log. haversines* of the sum and difference. The sum will be the *log. haversine* of the difference of bearing between the object and the heavenly body. Then compute the true bearing or azimuth of the heavenly body as usual (Art. 304). When this and the bearing of the object from the heavenly body are in the same direction, the sum will be the bearing of object: when the bearing of the object from the heavenly body is reckoned in the contrary direction, the difference will be the bearing of object.

Ex. July 10, 1835, at 7^h 0^m A. M. mean time nearly, in latitude 7° 51' S., and longitude 153° 10' E., the observed altitude of the sun's L. L. was 10° 30' 0'', and the observed distance of the sun's N. L. from a well-defined point of land on the same level with the eye and to the left of the sun was 95° 16' 0''. The index correction of the altitude sextant was -0' 50'', and that of the latter was +1' 10''; the height of the eye in taking the sun's altitude was 14 feet: required the true bearing of the point of land.

The compass bearing of the point was N. 5° 10' W.: required the variation of the compass.

Sh. July 9,	19 ^h 0 ^m	App. Alt.	10° 41' 14''
Long. in T.	10 13 E.	Tr. Alt.	10 36 24
	—	App. Dist.	95 32 55
Gr. July 9,	8 47	Sun's Semid.	15 45
Sun's P. D.	112° 23' 54''		

Diff. of Bearing.		Sun's Bearing.	
A. D.	95° 32' 55''	Lat.	7° 51' 0''
A. A.	10 41 14	T. A.	10 36 24
	106 14 9		2 45 24
	84 51 41		112 23 54
	—		—
	To left of Sun 95° 39' 0''		9.850385
	Sun S 114 39 15 E.		115 9 18 S 114° 39' 15" E.
	Point of land S 210 18 15 E.		109 38 30
	or N 30 18 15 W.		—
	Comp. Bearing N 5 10 0 W		—
	—		—
	Var. 25 8 15 W.		—

By this method the true bearing of objects in different points of the horizon may be found, and thus the variation determined with great accu-

racy. If the ship should change her position, by swinging round, it may be also seen immediately by means of any one of these objects, whether or not the variation alters. (See following remarks on the effects of local attraction.)

To determine the true bearing of an object on the same level with the eye as above, with as much exactness as may be required, it is necessary to attend to the following rules:

(1.) The heavenly body should be rising or falling fast at the time, and never more than 60° high.

(2.) The object should be nearly abreast of the sun, that is, nearly 90° from the point of the horizon to which the sun is vertical.

(3.) When rule (2) is not possible, care should be taken in choosing an object, so that the angle which the distance observed makes with the horizon (as estimated by the eye) may not be more than 45° .

If these rules be attended to, the true bearing may be determined within 3' or 4'. When the object is elevated above the level of the eye, it is necessary to observe its altitude or elevation. (See *App.* 50, 51, 52, &c.)

Remarks concerning the Variation of the Compass, and Cautions to be observed in the Use of this Instrument.

(308.) If a bar of steel of uniform thickness be supported at the middle point, it will be exactly balanced and at rest in a horizontal position, to whatever point in the horizon it is directed. If the bar or needle so placed be touched with magnets, it will immediately turn on its centre (supposed to be supported and yet to afford a free rotation), till it rests nearly in the plane of the meridian; at the same time one end will sink down and the other will be elevated. On the whole the needle will now lie in an inclined position to the horizon, having one end a little to the east or west of the plane of the meridian, and the other as far to the west or east thereof. This, generally speaking, is the natural position of a magnetised needle.

Let the elevated end be now made to descend into a horizontal position, a weight to be afterwards attached thereto, to keep it so, and the whole to be supported on a central pin. This is the position in which the needle is used in navigation. The angle which the needle, in its natural position, makes with the horizon at any place is called the *dip* *. The angle it makes with the meridian, that is, with a true north and south line, when kept horizontal by a depressing weight, is called the *variation*; west or east, according as the north end lies to the west or east of the meridian.

Since the dip changes as the place is changed, it must be necessary, in order to keep the needle horizontal, to shift the weight attached to one of the arms. In the northern hemisphere, generally speaking, the north end dips under the horizon; and in the southern hemisphere the south end, and this inclination increases as we approach the poles of the earth. Hence in the northern hemisphere generally the balancing weight must be put on

* An instrument called a *dipping needle* is used to measure this dip. It consists of a graduated circle having a needle supported at the middle on a transverse horizontal axis. The needle having been touched, the circle is placed in the magnetic meridian, that is, so as to pass through the horizontal plane in its position east or west of meridian. The dip is taken with the face of the circle both east and west. A mean of the readings off is the correct dip.

the south end of the needle, and pushed nearer the extremity as we sail farther to the north; in the southern hemisphere it must be put on the northern arm, nearer and nearer the extremity, as we get farther and farther to the south.

The needle thus brought into a horizontal position, points generally something to the east or west of the true north: this deviation or *variation* is different in different places, and varies in process of time at the same place. Hence arises the necessity of determining its amount at sea every day.

Besides the general tendency, by which the needle is disposed to deviate through a certain arc from the north, it is sometimes affected by local attraction, as by masses of iron that happen to be near it. Thus the variation may be altered. And moreover, should the position of the body, which so disturbs the needle, be changed, as from the east side to the west, the alteration in the variation is also changed, and even becomes of the opposite kind to what it was before. Now in a ship there is iron at no very great distance on every side of the needle, which may easily be supposed therefore to be affected thereby. If the effects of these disturbing forces be balanced, no deviation will be produced on the whole; but if not, then the variation, which the compass has, independently of such local attraction, will be altered; and as, in working the ship and bringing it on different courses, the iron must be carried round into different positions with respect to the needle, this alteration of the variation must itself undergo continual changes. If westerly variation be increased or easterly variation diminished, when the ship's head is in any one direction, the contrary effect will be produced on the variation, when the ship's head is brought round to the opposite point, that is, westerly variation will be diminished and easterly increased.

It appears necessary therefore in the application of the needle to the purposes of navigation, to determine the variation, when the ship's head is different ways. The simplest method is actually to find the variation by observation (Art. 304, 306, 307); when the ship lies on different points of the compass, at a time when this can be done most conveniently and correctly. The results may be inserted in a small table, such as the following, from which the proper variation, to be allowed according to the course steered, may be taken by inspection. The mean of all the variations put down will be the true variation.

First Table of Variations.

Ship's Head by Compass.	Variation.	Ship's Head by Compass.	Variation.
	° /		° /
North	24 30 W.	South	24 30 W.
N.N.E.	23 29 W.	S.S.W.	25 31 W.
N.E.	22 37 W.	S.W.	26 23 W.
E.N.E.	22 2 W.	W.S.W.	26 57 W.
East.	21 50 W.	West	27 10 W.
E.S.E.	22 2 W.	W.N.W.	26 57 W.
S.E.	22 37 W.	N.W.	26 23 W.
S.S.E.	23 29 W.	N.N.W.	25 32 W.

Second Table of Variations.

Ship's Head by Compass.	Variation.	Ship's Head by Compass.	Variation.
	° /		° /
North	32 30 W.	South	32 30 W.
N.N.E.	30 54 W.	S.S.W.	34 16 W.
E.N.E.	29 14 W.	S.W.	35 46 W.
N.E.	28 14 W.	W.S.W.	36 46 W.
East	28 0 W.	West	37 0 W.
E.S.E.	28 14 W.	W.N.W.	36 46 W.
S.E.	29 14 W.	N.W.	35 46 W.
S.S.E.	30 44 W.	N.N.W.	34 16 W.

From the above table it appears that the true variation, or mean of the whole, is $24^{\circ} 30' W.$ But in correcting courses (Art. 43), or in shaping courses, that variation must be allowed which is opposite the course. Thus, if the compass course be east, the variation to be allowed is $21^{\circ} 50'$, or about two points; if the compass course be west, the variation to be allowed is about $27^{\circ} 10'$, or about $2\frac{1}{2}$ points.

When a table, such as the above, has been once formed by good observations taken on every second point of the compass, it will be often unnecessary afterwards to find the variation with the ship's head on more than two points, namely, those on which there is the greatest and least variation. In the above case the ship's head should be brought east and west, when the sun's azimuth is observed. The mean of the resulting variations will be the true variation, and half their difference will be the greatest error. Thus let the variations, when the ship's head is E. and W., be now $28^{\circ} W.$ and $37^{\circ} W.$; then the true variation is $32^{\circ} 30' W.$, and the greatest error is $4^{\circ} 30'$. From these results a new table is easily formed as follows. Considering the degrees and minutes of the greatest error as minutes and seconds, find its *prop. logarithm* and write it down three times; underneath put the *log. secants* respectively of $22^{\circ} 30'$, of 45° , and $67^{\circ} 30'$, and add: the sums, rejecting 10 from each index, will be the *prop. logarithms* of three arcs, which take out as minutes and seconds, but consider as degrees and minutes. These three arcs will be respectively the deviations from the true variation at the distance of two, four, and six points from the points of greatest and least variation. The deviation at the distance of eight points is 0'. The following is the computation in the supposed case (see App. 60):

	$22^{\circ} 30'$	45°	$67^{\circ} 30'$	90°
<i>Prop. Log.</i>	1.59094	1.59094	1.59094	
<i>Log. secants</i>	10.03438	10.15051	10.41716	
	<hr/> 1.62532	<hr/> 1.74145	<hr/> 2.00810	
Errors	$4^{\circ} 16'$	$3^{\circ} 16'$	$1^{\circ} 46'$	$0^{\circ} 0'$
Tr. Var.	<hr/> 32 30	<hr/> 32 30	<hr/> 32 30	<hr/> 32 30
Adding.....	36 46	35 46	34 16	32 30
Subtracting	<hr/> 28 14	<hr/> 29 14	<hr/> 30 44	<hr/> 32 30

Diminishing the variations from the greatest by these steps, and increasing them from the least, we have a second table of variations similar to Table p. 160.

In the above method of proceeding, we suppose the greatest and least variations always to take place when the ship's head is in the same direction as in the first set of observations. But owing to a change in the stowage or equipment of the ship, or otherwise, this may not continue to be the case. It is necessary therefore, from time to time, to find the variation by observation, not only when the ship's head is on the supposed points of greater or least error, but also on the points contiguous thereto, and whenever a good opportunity occurs, as in the first case, on every second point. (See App. 61.)

By proceeding in this manner, the effect of the ship, in disturbing the position of the needle, will always be properly corrected.

It must be remarked, before we conclude this subject, that the variation is usually determined on board a ship by an azimuth compass, and applied, in working the log account or shaping a course, to the compass by which the ship is steered. It is obviously necessary therefore in making the proper observations, to see that there is an exact agreement between the two instruments, the steering compass being in the binnacle. And this must be done at every distinct observation, when the direction of the ship's head is changed.

Tides.

(309.) Suppose a spectator to be placed at the centre of the moon and to view from thence the earth, which may be considered as a perfect globe covered with water. Suppose also a straight line to be drawn from the spectator to the centre of the earth, and when produced to cut the earth's surface at two opposite points, that nearest to the spectator being denoted by A and the opposite one by A' . Then, since every particle of the earth is attracted or drawn towards the moon with a force varying inversely as the square of its distance, it is manifest that the most powerful attraction will be on the particles of water near A , and the least powerful on the particles near A' . A mean or average attraction will take place on the particles equidistant from these two points, that is, near a circle on the earth's surface perpendicular to the diameter AA' . The consequence must be, that the equilibrium of the water will be destroyed, and to restore it there must be an accumulation of fluid near A , or the point immediately before the lunar spectator, where the attraction towards the moon is the greatest: there must also be a similar accumulation at the opposite point A' , since the defect of attraction there must, as to the effect in question, be equivalent to an excess in the opposite direction. Upon the whole, therefore, the water will rise near A and A' , and consequently will fall near the circumference of a circle perpendicular to AA' ; or in other words, the water will rise towards the middle of the earth's disk or face as seen from the moon, and also near the point opposite to this; and will fall near the edge or limb of the disk.

The appearance then of the earth, to the lunar spectator, will be that of a spheroid with its longest diameter pointed to him. Let us now suppose the earth to have a whirling motion round its own axis from west to east. The question is, will the greatest accumulation of water, or the sharpest end of the spheroid, continue exactly under the moon? As each point in a particular circle of the earth, by its revolution, comes into this situation, the water will rise more and more at it; and when it passes under the moon the greatest effort will take place in raising the water. Afterwards this effort will diminish; still however the water will continue to rise by its own momentum; till this momentum being overcome by the tenacity of the fluid and its natural tendency now to fall, it will for a moment rest at the greatest elevation, when a few degrees east of the moon.

Taking into account therefore the rotation of the earth, the supposed spectator at the moon will see the highest accumulation of water, that is, the sharpest end of the spheroid, a little to the east of the middle of the earth's disk represented by A , as at A'' ; and the other sharp end will be to

the east of the point on the earth's surface opposite to A. The circle at low water will also take a position a little to the east of its former one.

If the moon be in the equator, or have no declination, each point of the terrestrial equator in revolving from west to east will have the high tide in succession. If the moon be north of the equator or have north declination, the high tide under the moon will lie continually in a northern parallel of latitude, and the opposite high tide in a southern parallel of latitude.

(310.) In the above observations we have supposed the earth to be a fluid globe. But in fact the surface is covered with water very partially. The South Pacific Ocean extends round a great part of the sphere; but the Atlantic does not stretch from east to west a fourth part of the circumference of the earth; while the other seas are of comparatively small extent; as the Mediterranean, the Caspian Sea, &c. We will inquire, for a moment, what difference this will cause in the appearance of the tides as seen from the moon. In the great Pacific Ocean we may suppose that the elevation of the water will be agreeable to the theory. But in smaller seas they can never reach their proper height. Thus in the Atlantic, when a place on the eastern side, as Teneriffe, in moving from west to east, is under the moon, a point on the western side, as Bermuda, will have passed the circle of low water. Hence it appears that there is not sufficient space for the full operation of the moon's influence in affecting the sea. Consequently neither the elevation nor the depression of the water will be so great as in the Pacific. In still smaller seas, as the Mediterranean, the Caspian Sea, &c. for reasons similar to those given above, the tides must be almost insensible.

(311.) A spectator, situated as we have supposed, will moreover see a great deviation from the theory in the hours of high water at different points, and in the direction in which the high wave reaches him.

In the Pacific the wave will swell from east to west, but in many seas, creeks, rivers, &c. the accumulation of water will flow from south to north, from north to south, or in any other direction, where the water is below its level; and when the external open sea comes to the position for a depression of water, this stream will be reversed, and soon there will be low water at the mouth of the passage in question, and then higher and higher up. In the mean time a second tide wave might be formed on the outside, and thus a second wave would enter the strait. So that we might have three or four high tides, and three or four points of low water at the same instant in a river or narrow sea.

If such a sea grew narrower as the tide wave proceeded up it, the water would then rise higher and higher by its own momentum, greatly above the level to which it would be brought independently of this circumstance.

(312.) The appearance, therefore, which the surface of the earth exhibits will be as follows. In the open sea, as the Pacific, an immense wave will be formed at every point as it comes to a position a little east of the moon, and the opposite point to the moon. This high tide will appear to supply ramifications of the ocean, as narrow seas, bays, rivers, &c. with waves flowing up them in various directions and various heights, according to the form of these inlets. In many cases there will be seen several waves or tides in such seas at once, and several intermediate low waters.

So that we may compare the tide accumulation of waters in the great

open seas to the overflowing of a vast reservoir, which supplies numberless pipes and streamlets attached thereto with successive influxes; returning again individually, as the reservoir presents a lowered state of the fluid.

(313.) It may be of use now to consider for a moment by what rule we should find the time of high water at any place, supposing the moon to act in raising the water.

In the great open sea, high water would take place about 80 minutes after the transit of the moon over the meridian, and also at the same time after the transit of the opposite point in the heavens. All we should have to do therefore, in order to find the time of high water, would be to add 80 minutes to the time of the moon's meridian passage as put down in the Nautical Almanac for the given day (correcting it for the longitude of the place). If the sum came out in the half day (A. M. or P. M.), on which we want the time of high water, the result would be correct. If it came out beyond that half day, we should in that case take the preceding transit of the opposite point in the heavens.

(314.) We will now consider the effect of the sun's attraction in raising the tides, or rather the combined effect of the sun and moon.

The effect of the sun must singly be of a similar kind to that of the moon; although from its greater distance the disturbing force of the sun is much less than for the moon. When the two bodies are in conjunction, and have the same declination, the high tide raised by each must be at the same place on the sea, a little to the east of them. And another joint high tide must be a little to the east of the point opposite to them.

When the moon, by its superior proper motion from west to east, is got to the eastward of the sun, the lunar and solar tides will no longer coincide. The highest point of the wave, considering the combined efforts of both bodies, will lie between the points where each singly would produce the highest wave. Hence two variations from the conjunction or change tide will take place; the tide will be less high, and will come sooner to a given place than before. This will be the case in a greater and greater degree till the moon gets into quadrature, or during the first quarter.*

In the second quarter the tide raised by the moon will be influenced, as to height and time, by the inferior solar tide, that is, by the tide on the opposite point of the earth to that under the sun. To this the lunar wave will come nearer and nearer as the moon goes through the second quarter, so that the height will increase and the time will be later than if the sun did not act.

When the moon comes into opposition, or is at full, the two tides will again coincide, and cause a great tide.

* The sun is at the distance of about 94 millions of miles from the earth, the moon describes an orbit round the earth at the distance of about 240 thousand miles; when the moon passes between the earth and sun it is said to be in *conjunction*, two or three days after which it is seen a little eastward of the sun like a crescent or letter C, with its back towards the sun. The enlightened disk afterwards increases, and when it has got a quarter of its orbit round the earth, reckoning from conjunction, it is said to be in *quadrature*: this is the end of the first quarter or the beginning of the second, the appearance of the moon being that of a luminous semicircle. When the moon has got a second quarter round the earth, or is on the opposite side of the earth to the sun, it is said to be in *opposition*, and is that time a full orb. After a third quarter the moon is brought again within one quarter of conjunction, and is again in quadrature, being reduced in appearance to a luminous semicircle. In the fourth quarter the moon is brought into conjunction again.

From full moon, through the third and fourth quarters to change again, similar variations will take place on account of the solar action, as from change to full.

(315.) By attending to the above general observations on this subject, the seaman will have little difficulty, it is presumed, in accounting for the principal phenomena of the tides. It is particularly necessary, however, to notice the following apparent deviation from the result of theory. The changes of the tides are found to be about a day and half later than theory would give. Thus the highest tides each month do not take place on the day when the moon changes or is at full, but generally the third tides after change and full are the greatest. Thus also the greatest excess of a spring tide does not happen when the moon is exactly in its perigee (the nearest point of its orbit to the earth), but about three tides after; and so of the other effects produced by any particular position of the sun and moon. These apparent anomalies are owing to the inertia of the fluid to be raised, and its inertia or momentum when it is raised. Hence when the amount of the acting force or the mode of its application is altered, it requires some time before the corresponding effect is perceptible; and when an effect is produced, it continues to be perceptible, although the cause shall have ceased, or undergone some new modification.

The principal phenomena of the tides, which fall under our observation, are as follows:—

(316.) It is observed that we have high water when the moon is nearly on some particular point of the compass, and also about $12^{\text{h}} 25^{\text{m}}$ (or half a lunar day) after this time. Generally the third tides after new and full moon are the highest. These are called *Spring Tides*. Generally the third tides after the commencement of the second and fourth quarters of the moon are the lowest tides. These are called *Neap Tides*.

If the moon at change or full happens to be in perigee, or its semidiameter about $16' 30''$, the spring tides are higher than usual. If this happens when the sun is also in perigee, or in January, the tides are still higher. At Brest the excess above the average spring tides from these causes is nearly three feet. When the moon, at change or full, is in apogee, or its semidiameter is about $14' 30''$, the spring tides are lower than usual.

The higher the tide rises on any day, the lower it falls at low water. The total height is the difference between low water and high water.

(317.) When the latitude of the place is of the same kind (N. or S.) with the moon's declination, the superior tide, that is, the tide which takes place when the moon is above the horizon, is greater than the inferior tide or the tide when the moon is below the horizon. This appears from the consideration that the high wave near the moon (309) will be formed in north latitude, but the opposite high wave will be in south latitude. Consequently the place of the spectator, as it revolves with the earth, in passing the moon itself, will have the tide higher than it will have in passing the opposite point of the circle of diurnal motion.

(318.) If the latitude of the place be of a different name (N. or S.) from the moon's declination, in that case the reverse of the above is expe

rienced; the inferior tide is greater than the superior. For the tide wave near the moon itself will be formed on a different side of the equator from that of the spectator; the tide wave near the opposite point will be formed on the same side. From the effects of local situation these circumstances do not always occur.

(319.) When the declination of the moon is equal to the polar distance of the place, the water will rise twelve hours and fall twelve hours. For in this case the low water circle will touch the opposite point of the parallel of latitude described by the place of the spectator as the earth revolves. After high water, therefore, the tide will ebb or fall till the spectator has reached the opposite point, or for about twelve hours.

(320.) The phenomena above described are supposed to take place in the open sea. In confined seas, rivers, &c. several of them will be considerably modified and even altered. For instance, at the Nore the inferior tide is higher than the superior tide, when the moon has north declination; which is owing to local situation, whence it happens that when an inferior tide is formed at the Orkney Islands in the open sea, a superior tide, ranging down the eastern coasts of Scotland, arrives at the Nore.

It has been found also by observation that the difference between the superior and inferior tide is much less than what theory indicates. This may be owing to the following circumstance:—The greater undulation in retiring from any part of the coast causes an accumulation of water in the smaller succeeding one, and thus makes the next tide greater on the shore than it would be independently of this.

(321.) One of the most remarkable anomalies in the tides is their greater elevation on different points of a shore to what they have attained in the open sea at a distance therefrom. This is supposed to be owing to the following circumstances:—First, a tide undulation or wave breaking on points of the shore is thrown as it were into heaps, and thus running up the different inlets which narrow gradually, is carried to a considerable height above the level a little outside. Secondly, it may sometimes happen that a tide vibrates between one part of the shore and another, and that the repeated influence of the sun and moon in raising the water may act altogether or partly in unison with these vibrations. Thus again the tides may be raised beyond the natural height.

In some places, instead of two tides in a lunar day, which theory would give, there is but one. This also is found to be owing to peculiarity of local situation. Whilst one tide is ebbing, another by a different channel is flowing; so that the height to which the water rises is the elevation of the greater tide above the depression of the less, and the lowest point to which it falls is the elevation of the smaller tide above the depression of the greater.

In fact there are few places where the phenomena of the tides are not more or less modified by the shape of the coast, or other peculiarities in the approaches to them. However, in one particular, theory and observation agree with great exactness, namely, in the successive intervals of high water; and we are thus enabled to compute the hour of high water very easily and correctly, provided we know it at change or full. For we have only to find the time of its theoretic accomplishment, and correct this by

the difference between the time of the observed change tide and the time given by the theory.

(322.) It is necessary here to remark, that the change tide, upon which we make the rest depend, is that tide which takes place (P. M.) on the day the moon changes; particularly on that day when the moon happens to change at noon. As the time of high water is considerably affected by the weather, it is usual to take the mean of a considerable number of observations for the average apparent time of change tide.

Rule for finding the Mean Time of High Water A. M. and P. M. on any given Day, the Apparent Time of Change Tide being given and Longitude of Ship.*

(323.) Mark one heading (1) towards the left hand side of the paper; a second heading a little farther to the right (2); and a third still farther (3). Under (1) put time of moon's Greenwich meridian passage on proposed day from Nautical Almanac: under (3) put time of Greenwich moon's meridian passage on preceding day; under (2) put a mean of the two passages already written down. Correct each of these by Nautical Tables (k), p. 5, entering with longitude of ship and difference of numbers under (1) and (3), and thus reduce the meridian passage to ship. Correct by Naut. Tables (l), p. 5 † the ship meridian passage under (1), and then add the given apparent time of change tide.

If the result under (1) be less than 12^h, it is the mean time of High Water P. M. for the proposed day.

If the result under (1) be greater than 12^h and less than 24^h, then work as described above with ship meridian passage under (2). Then if the result be greater than 12^h, reject 12^h, and you will have the mean time of High Water P. M. on the proposed day. But if the result of the second operation be less than 12^h, it will be the mean time of High Water A. M. on the proposed day.

If the result under (1) be greater than 24^h, work as described above with ship meridian passage under (3). Then, if the result be greater than 24^h, reject 24^h, and you will have the mean time of High Water P. M. on the proposed day. But if the result be less than 24^h, and greater than 12^h, reject 12^h, and you will have the mean time of High Water A. M. on the proposed day.

When the mean time of High Water has been found as above P. M., subtract therefrom the difference between meridian passages under (1) and (2); the remainder will be the mean time of High Water A. M. on the proposed day.

When the mean time of High Water has been found A. M., add thereto the difference between meridian passages under (1) and (2); and

* The *change tide* is here supposed to be the first tide P. M. on the day the moon changes or is at full (322). If the tide be given A. M. on that day as the *change tide*, it should be reduced to P. M. by adding 18 minutes, which may be considered as an average difference on that day.

† This Table is to be entered at side with ship mer. passage, corrected by Equation of Time to nearest minute applying it as to *mean time*, and at top with moon's semidiameter taken roughly from Naut. Almanac.

the sum will be the mean time of High Water P. M. on the proposed day.

It may be necessary to add 12^h , before this difference is subtracted, in which case the remainder will be the mean time of High Water P. M. on the preceding day: there will be no High Water A. M. on the proposed day. And if in adding the difference the sum be greater than 12^h , this sum (rejecting 12^h) will be the mean time of High Water A. M. on the following day: there will be no High Water P. M. on the proposed day.

Ex. 1. Required the mean time of high water on Aug. 29, 1835, A.M. and P. M., the change tide being at $4^h 10^m$ app. time, and longitude 100° W. Moon's semid. $16' 11''$ and Eq. of time 1^m subtractive from mean time.

	(1.)	(2.)	(3.)
Gr. Moon's Mer. Pass.	$4^h 34^m$	$4^h 8^m$	$3^h 43^m$
Table (<i>k</i>) . . .	$14+$	$14+$	$14+$
Sh. Mer. Pass. . .	$4 48$	$4 22$	$3 57$
Tide Table (<i>l</i>) . .	$1 15-$		
	$3 33$		
Change Tide . . .	$4 10$		
H. W.	$7 43$ P. M.		
	$26-$		
H. W.	$7 17$ A. M.		

Ex. 2. Required the mean time of high water on Aug. 6, 1835, A. M. and P. M., the change tide being at $2^h 58^m$, app. time, and longitude 20° E. Moon's semid. $15' 48''$; Eq. time 6^m subtractive from mean time.

	(1.)	(2.)	(3.)
Gr. Moon's Mer. Pass.	$10^h 36^m$	$10^h 5^m$	$9^h 35^m$
Table (<i>k</i>) . . .	$3-$	$3-$	$3-$
Sh. Mer. Pass. . .	$10 33$	$10 2$	$9 32$
Tide Table (<i>l</i>) . .	$21+$	$25+$	
	$10 54$	$10 27$	
Change Tide . .	$2 58$	$2 58$	
Gr. than 12^h	$13 52$	H. W. $1 25$ P. M.	
		$31-$	
		H. W. $0 54$ A. M.	

Ex. 3. Required the mean time of high water on Aug. 20, 1835, A. M. and P. M., the change tide being at $6^h 20^m$ app. time, and longitude 56° W. Moon's semid. $15' 7''$. Eq. time 3^m subtractive from mean time.

	(1.)	(2.)	(3.)
Gr. Moon's Mer. Pass.	21 ^h 48 ^m	21 ^h 21 ^m	20 ^h 55 ^m
Table (<i>k</i>)	8+	8+	8+
Sh. Mer. Pass.	21 56	21 29	21 3
Tide Table (<i>l</i>)	20+		19+
	22 16		21 22
Change Tide	6 20+		6 20+
Gr. than 24 ^h	28 36		H. W. 3 42 P. M. 27—
			H. W. 3 15

Ex. 4. Required the mean time of high water on May 10, 1835, A. M. and P. M., the change tide being at 1^h 40^m app. time, and longitude 110° E. Moon's semid. 16' 35". Eq. time 4^m additive to mean time.

	(1.)	(2.)	(3.)
Gr. Moon's Mer. Pass.	10 ^h 27 ^m	10 ^h 1 ^m	9 ^h 35 ^m
Table (<i>k</i>)	16	16—	16—
Sh. Mer. Pass.	10 11	9 45	9 19
Tide Table (<i>l</i>)	31+	34+	
	10 42	10 19	
Change Tide	1 40+	1 40	
Gr. than 12 ^h	12 20	H. W. 11 59 A. M. 26+	No Tide May 10, P. M.
		12 25	
			H. W. May 11, 0 25 A. M.

Ex. 5. Required the mean time of high water on April 23, 1835, A. M. and P. M., the change tide being 2^h 0^m app. time, and longitude 90° W. Moon's semid. 15' 0". Eq. time 2^m additive to mean time.

	(1.)	(2.)	(3.)
Gr. Mer. Pass	21 ^h 44	21 ^h 23 ^m	21 ^h 1
Table (<i>k</i>)	11+	11+	11+
Sh. Mer. Pass.	21 55 19+	21 34	21 12 18+
	22 14		21 30
Change Tide	2 0		2 0+
Gr. than 24 ^h	24 14		23 30
		H. W. 11 30 A. M. 21+	
		H. W. 11 51 P. M.	

Winds.

(324.) Air is an elastic fluid, which surrounds the earth, and reaches to the height of about 80 miles above it. The equilibrium of this fluid is frequently disturbed by partial rarefactions and condensations; in consequence whereof it moves, in a current, from the denser to the rarer parts. These currents are called winds.

The earth, together with the atmosphere or air which rests on it, revolves once in twenty-four hours from west to east. In consequence of this rotation, the parts of the atmosphere towards the equator move faster than those to the north or south. Suppose a portion of air to be suddenly transferred from a high northern or southern latitude to the equator. Then this transferred portion, having a less velocity eastward than the spot on which it is placed, must have a relative westerly motion; that is, a spectator must feel it apparently blowing from the east.

Now such a transfer is in fact constantly taking place; for the equatorial parts of the earth being the hottest, the particles of air are there expanded and rise upwards, and the cooler air to the north and south flows in. The air to a certain distance on the north of the equator thus in reality moves southward, while at the same time the effect of the earth's rotation is to give it an apparently westerly direction. Upon the whole therefore a N. E.* wind is produced.

For similar reasons to a certain distance south of the equator a S. E. wind is constantly blowing.

These N. E. and S. E. winds are called Trade Winds. They extend to about 30° of latitude on each side of the equator, more or less according to the season of the year, as well as to local circumstances.

As the currents of wind in blowing from the N. E. and S. E. approach the equator, they become more easterly. At the equator, or rather from about 2° to 5° north latitude†, they blow due east. For here the northerly and southerly currents destroy each other, and nothing remains but the apparent westerly motion arising from the earth's rotation. Frequently squalls and rains are found to prevail in this zone or track of the sea.

(325.) To the east of Africa, in our summer months, or from April to October, the air over the continent of Asia is very greatly heated and rarefied; in consequence whereof the S. E. trade winds pass the equator, and move considerably to the north. But having acquired, in passing the equatorial parts, the greatest rotatory motion of the earth, when they have got further northward, they have a greater easterly motion than the points arrived at. Over the Arabian Sea and Bay of Bengal these winds therefore at this season of the year blow from S. W.; at the equator nearly south.

* Two other reasons are assigned for this westerly motion of the current: the diurnal motion of the sun, and therefore of the hottest point of the earth, westward; and the effect of the sun and moon in raising a tide in the atmosphere (see Articles on the Tides), by which the accumulation of air is made to move from east to west, and thus causes a current in that direction.

† The sun being perpendicular to the equator twice in the year, and never farther from it than 23½°, the average heat here is the greatest. Taking also into account the superior length of the summer in the northern hemisphere (about 16 days), arising from the elliptic form of the earth's orbit, the circle of greatest heat is carried a little north of the equator, namely, to the zone between 2° and 5° north latitude; variable a little with the place of the sun.

Between Madagascar and Africa they blow directly through the channel, or about S. S. W.

In our winter months, that is, from October to April, the sun having south declination, the continent of Asia becomes cold, and the winds on the north side of the equator blow from the N. E. ; they extend even over the equator, as far as about 3° S. To the south of the line the S. E. trade winds stop at about 10° south latitude. From 10° to about 3° the winds blow from the N. W.

At this season between Madagascar and Africa the winds blow N. N. E. directly through the channel, in the opposite direction to the winds there in our summer months.

(326.) The winds which in the Arabian Sea and Bay of Bengal blow six months in one direction and six months in the other, are called *monsoons*, from a Malay word signifying season.

(326.) To the eastward of Sumatra and Malacca, along the coasts of Cambodia and China, similar monsoons prevail and change at the same time, namely about the equinoxes. These however are more northerly and southerly than the ones just described. They extend as far as the Philippine Islands and Japan, and immediately to the south of the line as far as New Guinea. For about a month near the changing of the monsoons very great storms of wind are usually experienced.

Over the Pacific Ocean, out at sea, the regular trade winds blow within the limits above mentioned.

(327.) From about 30° of north or south latitude to 40° , chiefly westerly winds prevail, though not with the same regularity as the trade winds nearer the equator. They may be accounted for in some measure thus. When the air is rarefied near the line, it ascends, and forms a counter current to the air below. In the northern hemisphere it flows to the north ; but having acquired at the equator the greatest easterly motion of the earth's surface, in passing to the north, it comes to parts that have a less rapid motion. It consequently takes a relative easterly direction. The northerly motion of this current is checked and destroyed in the track between 30° and 40° . Still however its easterly motion remains and is communicated to the substrata of air with which it here mixes ; thus causing the westerly wind observed.

In like manner, within the limits in the southern hemisphere, the westerly winds prevail.

(328.) In maritime countries, where the heat of the sun is considerable, during the day the wind blows from the sea towards the land, and in the night in an opposite direction, or from the land towards the sea. The reason, after what has been said, will be easily seen. In the daytime the land, being a denser body than the sea, acquires heat faster, and communicates it to the superincumbent atmosphere, which is thus rarefied. The current of air is therefore from the sea. But in the night, the land, for a similar reason, loses heat faster than the sea, and thus becomes more cool and more dense. The current is therefore from the land to the sea. These winds are called land and sea breezes.

Having endeavoured in the above articles to give the seaman some general notion of the principal facts relating to the trade winds and monsoons, and the causes which produce them, it may be proper now to state

other subordinate observations that have been made on this subject, together with several modifications of the principal winds, described above, and exceptions to them, which arise from local circumstances.

(329.) The regular trade winds prevail only in the open seas. Towards the land they undergo different variations. In the Atlantic they extend farther north or south by 3° or 4° on the American side than on the African; extending on the American side to about 32° , and on the African to about 28° .

Towards the Caribbee Islands the trade wind blows more easterly, so as to be sometimes E. and E. by S.; but generally a point or two north or east.

Near the coast of Africa the winds deviate very greatly from the regular direction of the trade winds. From Cape Boyador to Cape Verde the winds are generally N. W.; from Cape Verde to the Island of St. Thomas they blow right on the shore, bending gradually to the W. and then to the S. W., as we approach the Cape of Good Hope.

On the coast of New Spain from California to the Bay of Panama, the winds blow almost constantly from the west and S. W., except during the months of May, June, and July, when the land winds prevail.

On the coast of Chili and Peru, from 20° to 30° south latitude to the equator, the wind blows constantly from the south, varying according to the direction of the land towards which it inclines.

The trade winds are interrupted sometimes by westerly winds in the Bay of Campeachy and the Bay of Honduras.

In most *tropical* countries, it appears that the wind generally blows from the nearest ocean, except during the coldest month, when it blows towards the nearest ocean.

In the *temperate* zones, the winds are by no means so regular as between the tropics: they may hence be considered as variable, though upon the whole it is found that the westerly winds are the prevalent ones (330).

Over the whole eastern coast of North America in the temperate zones the winds are most frequently from the west. In South America within the same limits, S. W. winds predominate, and the N. W. winds become gradually more frequent in approaching the frigid zone.

In the Mediterranean the wind blows nearly three-fourths of the year from the N.; about the equinoxes there is always an easterly wind. In the Gut of Gibraltar there are seldom any winds but E. and W. At Bastia, in the Island of Corsica, the prevailing wind is the S. W.

The following is an average account for 10 years of the direction in which the wind blows at London:—

Winds.	Days.	Winds.	Days.
S. W.	112	S. E.	31
N. E.	58	E.	26
N. W.	50	S.	18
W.	53	N.	16

(330.) The following table shows the number of days during which westerly or easterly winds have been found on an average to prevail in different parts of England. By westerly winds are meant N. W., W., S. W., S.; the term easterly is taken with the same latitude.

Years of Observation	Places.	Winds.	
		Westerly.	Easterly.
10	London	233	132
7	Lancaster	216	149
51	Liverpool	190	175
9	Dumfries	227.5	137.5
10	Branhholm	232	133
7	Cambuslang	214	151
8	Hawkshill, near Edinburgh . .	229.5	135.5
	Medium . .	220.3	144.7

In Ireland the S. W. and W. are the prevailing winds, blowing most in summer, autumn, and winter. The N. E. blows most in the spring, and nearly double to what it does in autumn and winter.

Upon the whole it appears that the prevailing winds on the south coasts of Europe are the N., N. E., and N. W.; and on the western coasts the S. W. Westerly winds are most frequent on the N. E. coast of Asia.

In the south temperate zone, which is in a great measure covered with water, the winds may be supposed to be more uniform than in the north temperate zone, where their direction will frequently be affected by mountains and other causes.

At the Cape of Good Hope the principal winds are the S. E. and N. W.; other winds seldom blow more than a few hours; and the E. and N. E. winds very seldom. The S. E. wind blows chiefly from October to April; the N. W. prevails from April to October, being accompanied with rain and storms. Between the Cape of Good Hope and New Holland the winds are commonly westerly, and blow in the following order: N. W., S. W., W., N.

In the Great South Sea from latitude 30° to 40° , the S. E. trade wind is prevalent, especially in our winter months. The wind next to it in frequency is the N. W., and next to that the S. W.

Beyond the influence of the trade winds, which extend farther into the south temperate zone than their usual limits, particularly in the southern summer, the winds are usually westerly, and they blow in the following order: N. W., S. W., W.

(331.) The sea and land breezes which prevail on the coast of all tropical countries, and where the sun has great power, have been already mentioned and explained. It may be proper to add here, that such places are also liable to sudden and violent squalls from the land, especially where the country is mountainous. For, when rarefied air is raised over the sea by the heat of the sun, in floating along the upper regions of the atmosphere, it frequently falls in with the tops of the hills, and is suddenly cooled and condensed: in consequence whereof it is precipitated towards

the coast, and forms a strong wind in that direction. The seaman well knows how necessary it is, in such situations, to be constantly on his guard against the effects of these sudden land squalls

(332.) Very often before a gale of wind, or bad weather at sea, the mercury in the barometer will fall very rapidly. This instrument therefore furnishes the seaman with a very simple and important method of often foreseeing and preparing for such changes. The quicksilver is raised up the tube, from which the air is exhausted, by the pressure of the external air on the quicksilver in the basin or bulb; and whenever this pressure undergoes any change by the accumulation or reduction of the external air, by its horizontal motion in high winds, by electric or other chemical changes, the quicksilver will rise or fall. It is difficult in many instances to account for the variations to which it is liable: the seaman must trust principally to the results of his own repeated observations, if he wish to derive all the advantages from the barometer which it is possible to do. The following phenomena have been deduced from a number of observations.

1. The rising of the mercury presages, in general, fine weather; and its falling, foul weather, as rain, snow, high winds and storms.

2. In very hot weather, the falling of the mercury foreshows thunder.

3. In winter, the rising presages frost; and in frosty weather, if the mercury falls three or four divisions, there will certainly follow a thaw. But in a continued frost, if the mercury rises, it will certainly snow.

4. When foul weather happens soon after the falling of the mercury expect but little of it; and on the contrary, expect but little fair weather when it proves fair shortly after the mercury has risen.

5. In foul weather when the mercury rises much and high, and thus continues for two or three days before the foul weather is quite over, then expect a continuance of fair weather to follow.

6. In fair weather, when the mercury falls much and low, and thus continues for two or three days before the rain comes, then expect a great deal of wet, and probably high winds.

7. The unsettled state of the mercury denotes uncertain and changeable weather.

(333.) A particular kind of barometer, called a Marine Barometer, is constructed for use at sea. The lower part of the tube is made very small, and for about five inches at the head of the quicksilver the tube is enlarged; the instrument is suspended by a spring and jimbols. By these contrivances the tube is kept nearly vertical, and its oscillations rendered less sudden. And, from the smallness of the bore of the tube downwards, sufficient mercury cannot be propelled through it, in one of these oscillations, to disturb much the head of the mercury.

Experiments have been made, though not of a decisive kind, to determine the velocity of the wind. In a great storm it is supposed to move from 60 to 70 miles in an hour; in a fresh gale about 21 miles an hour; in a small breeze, about 10 miles*.

* On the subject of winds, see article *Meteorology* in *Encyclopedia Britannica*, from which most of the above facts respecting them are taken.

On Hadley's Sextant.

(334.) By *light* is meant that medium, which connects any object with the eye, so as to produce the sensation of vision. It is supposed to consist of very minute particles of matter, which are incessantly thrown off from each point of a luminous body, in the direction of radii diverging from that point as a centre. The velocity with which these particles move has been found from astronomical observations to be about 195,000 miles in a second.

By a *ray* of light is meant a single line of such particles; or, considering light as a fluid extremely thin and rare, a ray may be defined to be the least quantity of that light which can be stopped or propagated alone.

By a *pencil* of rays is meant a number of rays taken collectively and distinctly from the rest.

When a pencil of rays fall on the eye, one of them, which is called the *axis* of the pencil, is supposed to pass through the eye in a straight line. The other rays of the pencil are refracted by the different parts of the eye, so as to meet the axis on the *retina* or innermost coat. The impression there made by the impact of the whole together is communicated by the optic nerve to the brain, and the sensation is caused which is called vision.

Hence it appears that, with respect to the direction in which an object is seen, we may suppose vision to be produced by the axis of the pencils alone, that is, by single lines proceeding from the several points of an object. Such lines will be hereafter called *visual rays* or *lines of vision*.

Light is propagated in straight lines, as long as it continues in the same medium, as in air of uniform density, water, glass, &c. This we conclude from our not being able to see objects through tubes, unless they are straight; and from observing the shadows of opaque bodies, that is, of bodies not penetrable by light, to be formed agreeably to such a supposition. But whenever light falls obliquely on the surface of a medium different from that in which it has before moved, it is then bent from a straight course, either by *refraction* or *reflection*.

A ray of light is said to be *refracted* when it afterwards enters the other medium, but in a bent course: it is said to be *reflected* when it turns back into the medium from which it came.

The plane passing through an incident and refracted ray, or through an incident and reflected ray, is always perpendicular to the surface upon which the ray has fallen: also the angles which the incident and reflected rays make with the surface are equal. This is the result of experiment.

An object is not always seen in the direction in which a visual ray flows from it, but in the direction in which a visual ray enters the eye and make an impression on the retina. And hence it often happens, when the course of rays is changed in their transit, that objects appear in places where in reality they do not exist. Thus rays from the sun, moon, &c. falling obliquely on the surface of a river are reflected to the eye, and the images of those shining bodies are seen beneath the water.

(335.) To apply the above general observations to the construction and use of Hadley's sextant, let an object at A (fig. Art. 208) be viewed by an eye placed at E, through a straight line XY, which both transmits and reflects light, and let AC, a visual ray, proceeding from A, in the plane of

the paper, fall on another reflecting straight line PQ, which makes equal angles with CA and CD, and therefore reflects it along the line CD, making the same angle with XY that DE does.

Then, by the laws of reflection (334), XY will again reflect the ray CD in the direction DE; consequently the impression on the eye by this reflected ray will coincide with that from the direct ray ADE. The object at A therefore seen directly and by reflection will appear single.

The reflection, as well as the direct vision, is supposed to take place in the plane of the paper.

Let now a second visual ray, proceeding from another object B in the same plane, fall on the reflecting straight line at C, making with it an angle BCP. Then, if PQ be turned in the plane of the paper through an angle PCI equal to half ACB, the angle BCI, which the incident ray makes with the reflector, will still be equal to the angle which DC makes with it; for the less of two unequal angles BCP and DCQ is thus increased by half their difference, and the greater diminished thereby. Consequently BC will be reflected by IN along CD, and, after a second reflection at D, the ray from B will enter the eye at E in the same line with the ray AE from E; or in that position of the reflectors the two objects at A and B will be seen in the same direction.

Let IN and PQ be supposed to be produced to cut a graduated arc, described from the centre C and with any radius CF, in G and F; then the degrees, minutes, &c. in FG will measure the angle FCG, or half the angle ACB, between the objects A and B.

The reflections have been supposed to be produced by straight lines XY and PQ placed in the plane of the arc FG; the same conclusions would manifestly hold good, if these lines and the course of the rays were elevated above or depressed below that plane, provided they were in a plane parallel thereto, and the point of the intersection of PQ and IN were immediately over or under the centre of FG. In other words, our conclusions would be true, if XY and PQ were reflecting surfaces, as of glass, placed perpendicular to the plane of FG; supposing PQ to be turned round an axis perpendicular to the plane of FG, and passing through the centre of FG; and the view to be directed along a line ED parallel to the same plane.*

(336.) Hence we easily see, in a general point of view, the construction and use of Hadley's sextant. A small square piece of finely polished glass quicksilvered at the back is placed at C perpendicular to the plane of the instrument. It is attached to a moveable radius, by which it is turned round an axis perpendicular to the plane of the instrument, and passing through the centre of an arc FG. Another similar piece of glass is placed at D, with its surface also perpendicular to that of the instrument. The lower half of this is quicksilvered at the back; the upper half is left transparent. At E there is a small plate of brass, in which is a small hole where the observer places his eye. To take the angle between two objects, he looks directly at the left hand object through the middle of the fixed glass, just at the upper edge of the quicksilver. He then moves the radius attached to the moveable glass, and thus turns round the reflector at C, till

* When the two reflecting planes are perpendicular to the plane of the arc, the course of every axis of a pencil of rays, by which an image is formed in the eye, must evidently be in a plane parallel to the arc, as is supposed here.

he sees the right hand object in the same direction with the other. He afterwards brings the moveable radius back, and places it so as to see the left hand object by reflection, and directly in the same line, that is, till it appears single. The arc between the two stations of the index on the moveable radius, thus determined, is half the angle which the objects subtend at the middle of the moveable reflector. Let FG (fig. p. 90) be that arc; then if the divisions commence at O , and F lie to the right of O , there will be two readings off, namely, OG on the arc and OF off the arc. In that case the sum will be the degrees, minutes, &c. in half the required angle, if the arc were divided into its proper number of degrees, minutes, &c.; but the arc on Hadley's sextant being divided into twice the number of degrees it should properly contain, the sum read off will be the whole arc required at once. If F coincide with O , there will be but one reading off; if F be to the left of O , or on the same side of O as G , the difference of the arcs read off will be the angle required.

Reading off on Hadley's Sextant.

(337.) The arc of Hadley's sextant is divided into degrees by lines cut therein, which lines tend to the centre of the instrument. A degree is subdivided in some cases into two equal parts, each of which is $30'$; in others into three equal parts, each of which is $20'$; in others again, into four equal parts, each of which is $15'$; and, lastly, into six equal parts, each of which must be $10'$. The index, up to which an arc is read off, is a line cut in a plate at the end of the moveable radius, tending also to the centre of the quadrant. Supposing this index to stand exactly at any of the lines on the arc, that is, so that the two lines are in the same direction; in such a case the reading off is easily known: for it must be a certain number of divisions and subdivisions of which the value is seen at once. Thus, if a degree on the arc be subdivided into three equal parts of $20'$, and the index stand at the second line from the one marked 30° , then the reading off is $30^\circ 40'$.

But suppose the index not to stand exactly at any line whatever on the arc, but somewhere between two, as, in the just-mentioned example of division, between the second and third; then the reading off will be $30^\circ 40'$, together with the small space which the index is in advance of $40'$. The value of this small space is known by means of a few divisions on the index plate to the left of the index. These divisions are made less than the arc divisions, so that the line on the plate immediately to the left of the index is somewhat nearer to the corresponding one on the arc than the small space to be determined. It is nearer thereto, as is manifest by the difference of a division on the arc and one on the index plate. In like manner the second line, reckoning from the index, must be nearer to the corresponding arc line by two differences, the third by three, and so on. At length therefore there must be a coincidence of two lines, or nearly so, that is, they must appear to an eye placed directly over them to lie in the same direction, or nearly so. And since, upon the whole, the lines on the index plate have approached those on the arc through the small part the index is in advance of $40'$, this excess must be equal to as many times the difference of two divisions, as there are lines, reckoning from the index, before this coincidence takes place. Hence, if we know the value of a difference, we easily know the value of the excess in question.

This difference is known as follows:—By examining the index plate we always find some of the lines distinguished by numbers; these denote

minutes. Thus the numbers 5, 10, denote 5' and 10'; that is, they show that the difference between the divisions up to these marks is 5' or 10'. Suppose it appears that the interval between 5 and 10 is subdivided into 5 parts, then it is evident that the single difference in question must be 1'; if into 10 parts it must be 30". Again, suppose the numbers on the index plate are 1, 2, 3, &c. which denote 1', 2', 3', &c.; and the interval between them is divided into 6 parts; then the difference of a division on the arc and one on the index plate must be 10". This last is the most usual kind of division.

(338.) To read off then on Hadley's sextant, we first examine the divisions and subdivisions on the arc, up to the line which stands before the index. We then move a microscope on the index plate, and examine the numbered lines. If any one of these coincide in direction with the opposite line on the arc, the reading off to be added will be so many minutes. If not, we observe between which numbered lines the coincidence actually takes place; and then reckon the preceding minutes as numbered, and afterwards the subdivisions of index plate, as so many minutes or seconds. For example, the arc of the sextant is divided into degrees, and each degree into 6 parts of 10'; and the index stands between the second and third subdivisions from 30°. In reading off, first 30° 20' is noted on the arc; and then running the microscope farther on the arc, it is observed, that a line on the index plate and an arc line are in the same direction between 4 and 5. The farther reading off is therefore 4' and some seconds. On examining the interval between 4 and 5, it appears to be divided into 6 parts, and the third line is in the same direction with the opposite one on the arc. The remaining reading off is therefore 30". Hence the whole reading off is 30° 24' 30". Again the arc of another sextant is divided into degrees, and each degree into 3 parts of 20', and the index stands between the second and third subdivisions from 60°. The reading off is therefore 60° 40', and something more. On examining the index plate it is observed that the coincidence takes place between the numbers 10 and 15; the farther reading off is therefore 10', and something more. On examining the intermediate divisions it is found that there are five longer lines, which must be minutes, and five shorter lines which must be 30", and that the coincidence lies at the short line next to the third longer from 10'. The remaining reading off is therefore 3' 30"; and upon the whole the arc is 60° 53' 30".

(339.) The division of the arc and of the index plate has been supposed above to be from right to left. But a similar method of reading off is pursued when the division is from left to right. The line on the arc is noted, which lies immediately before, that is, in this case, to the left of the index, and the additional small space is known by moving the eye along the line on the index plate from left to right.

(340.) Sometimes it is required to read off an arc divided from left to right by means of an index plate divided from right to left. In this case it is only necessary, in reading off the minutes and seconds on the index plate, to consider the terminating line on the plate as the index, and reckon the divisions back. Thus, if there be twenty divisions on the plate, and the numbers are 5, 10, 15, 20, the line marked 20 is considered as the index, 15 is considered as 5, and 5 as 15. The reading off is in other respects the same as before.

(341.) Sometimes the index plate is divided both to the right and left of the index, in which case, in reading off, we proceed as usual to the termination of the lines on the plate, going the same way as the divisions on the arc. If there be not a coincidence up to the end, we then pass to the other extreme line, which is similarly situated with respect to its opposite line on the arc as the one on the left, and then examine from thence the line back to the middle or index. In other respects we proceed as before.

Adjustments of Hadley's Sextant.

(342.) Before we describe the adjustments of Hadley's sextant, it may be proper to give a more particular account of the manner in which it is used in taking the angle between any two objects A and B, of which A is supposed to be the left of B.

The observer takes the handle of the sextant, which is underneath the instrument, in the hollow of his right hand, and closes his hand gently upon it, so as to hold it securely and yet not too firmly. Having estimated the angle between the objects A and B by the eye, he moves the index with his left hand nearly to that angle on the arc; bringing the instrument, with the graduated arc or face upwards, to his eye, and holding it, as nearly as he can guess, so as to lie in the plane* of A and B, he directs his view from the place for the eye through the middle of the fixed reflector, just above the quicksilver, to the left hand object A. If the angle to which the index is put be nearly right, and the face of the instrument is held so as to be in the plane of A and B, he will then see not only A directly, but also the image of B near to A. But it is not probable that he will hold the instrument in the proper position at first: as soon therefore as he sees A, he turns the quadrant slowly round the hand, by which he holds it, to the right and left, by which he is sure of bringing it into the proper position. If, therefore, in so turning it, he sees the image of B near A, he alters the index a little, if necessary, with his left hand, till this image more nearly coincides with A, and then turns the screw under the index plate and arc; thus fixing the index at its present place. He then takes the screw at the end of the index plate, called the tangent screw,† between the forefinger and thumb of the left hand, the thumb being at the top; at the same time supporting the sextant with the other fingers of his left hand under the arc. Turning this screw gradually, the index is moved also gradually, and thus the image of B is brought exactly to coincide with A.

If, on turning the instrument round, as described above, he does not see the image of B near A, the observer in that case tries a little on each side of A till he finds the image, which he then moves up to B by pushing forward or back the index. He then clamps the screw under the arc, and makes a coincidence with the tangent screw as above.

Or thus. Holding the index plate with the left hand, direct the view through the fixed reflector to the *right hand* object B, keeping the plane of the sextant so as nearly, when extended, to pass through B and A. Then push forward the index gently, by which the image of B will appear to separate from B itself, and to move to the left. Thus carry the image up

* This plane may be nearly estimated by passing the open hand between the two objects.

† This first step should be taken without the telescope in a rough way. When the tangent screw is to be used the telescope should be screwed in. (See following Articles.)

to A, or nearly so; and then clamp the index plate. Having done this, make an exact coincidence of the image of B with A by means of the tangent screw.

The arc at which the index stands must now be read off, first the divisions and subdivisions of the arc, then the divisions and subdivisions of the index plate (see Art. 338). Having read off this arc, the observer unclamps the screw under the arc, and brings, with his left hand, the index nearly to the commencement of the divisions; moving it gently backwards and forwards there, till he sees the image of A near A itself; he then brings this image as near to A as possible by the hand. The screw being again clamped, he proceeds to bring them exactly together, that is, to make A single by the tangent screw. The arc at which the index now stands being read off, it is added to the arc already noted, or subtracted therefrom, according as the index stands, in the latter operation, to the right or left of the commencement of the divisions. The result will be the angle which A and B subtend at the eye.

(343.) Sometimes it is necessary, in observing the angle between two objects A and B, to look directly at the one to the right, and make the image of the left hand object coincide therewith. In this case the face of the sextant is held downwards, the right hand of the observer and the handle being above, so that the instrument is suspended from the hand. The view is then directed from the eye-hole through the fixed reflector to the left hand object A. The image of A is then brought up to B, and made to coincide with it as in the former case, and the arc read off. When this is done, the index is brought back nearly to the commencement of the divisions on the arc, and the right hand object B is made to coincide with itself, in the same manner as before. The sum or difference of the readings off, according as in the latter operation the index stands off or on the arc, will be the angle required.

(344.) If, as is frequently the case, a telescope be used in observing the angle between two objects A and B, in that case we proceed as follows. The image of the right hand object B is brought up very nearly to A without the use of the telescope, as explained above. The telescope is then adjusted to distinct vision, by looking through it at a distant object, and is afterwards gently screwed into the socket at E, or the place of the eye. If necessary, it is raised by a screw or depressed, so as to point to the edge of the quicksilver on the fixed reflector. When this is done, the observer looks through the telescope, and turns round the eye tube, that is, the tube which carries the eye glass and is pushed in or pulled out to get distinct vision, till two wires in the field of view appear parallel to the plane of the sextant. Lastly, he views the left hand object through the telescope, and alters the eye tube, if necessary, till it is seen quite distinctly. The instrument is thus prepared for taking the angle.

After resting a short time, the observer brings the telescope to his eye, holding the sextant so that its plane may pass nearly through A and B. He looks through the telescope at the left hand object A, and vibrates the instrument till he sees B near A. He then makes an exact coincidence by means of the tangent screw at the middle of the field of view.

(345.) Having read off the arc, the observer unclamps the screw under the arc, and bringing the index nearly to the commencement of the

divisions, makes the left hand object nearly coincide with itself. He again clamps the screw, and makes an exact coincidence by the tangent screw at the middle point between the wires. The arc at which the index stands being then read off, it is applied to the former reading off by addition or subtraction, according as it is off or on the arc. The result is the angle required.

(346.) Generally, the telescope, used with a sextant, inverts objects seen through it; that is, in looking through it, objects on the right appear to the left, and those on the left appear to the right: also objects really above others appear below, and conversely. Such a telescope is used, in order to get a considerable magnifying power with less loss of light than would take place in a telescope of equal magnifying power which does not invert. The observer will experience some little difficulty at first from this apparent misplacing of objects, but after a very little practice it will not occasion any trouble or error.

We shall now explain the adjustments of the sextant, which it is very necessary the observer should thoroughly understand. We shall afterwards describe particularly the different kinds of astronomical observations made with this instrument, as taking the altitude of a heavenly body at sea, the distance of the moon from the sun or star, &c.; giving at the same time such directions as may appear useful.

First Adjustment.

347.) The moveable reflector placed at the centre of the sextant has been above supposed to be perpendicular to the plane of the arc. It is necessary therefore from time to time to see that this is the case. For this purpose take the handle of the instrument in the left hand, with the face of the quadrant up. Bring the movable reflector near to the eye, and look into it obliquely (as in the line BC, fig. p. 90), so as to see the image of the arc. If this image be in the same plane with the arc itself, so as to form apparently a single unbroken arc, in that case the moveable reflector is right placed.

But if this image be thus seen above or below the arc itself, in that case the fixed reflector is not perpendicular to the plane of the arc, and its position must be gradually and carefully altered by means of the screws at the back of it, till the adjustment is by this criterion shown to be complete.

It must be observed, however, that this adjustment is very seldom found to be erroneous, as instrument makers fix the reflector in question very securely in its proper position at first.

Second Adjustment.

(348.)* The fixed reflector should also be perpendicular to the plane of the arc. Whether it is or not may be ascertained as follows:—look

* The telescope is supposed to be adjusted to distinct vision, to be properly screwed into the collar, and the wires by turning round the eye-tube to be set parallel to the plane of the sextant. The two suns viewed are supposed to be seen distinctly at the middle point of the field of view, and to be brought to a convenient and equal brightness, by placing a dark glass on the eye end of the telescope, by other dark glasses before the reflectors, and in a smaller degree by screwing the telescope nearer to or farther from the plane of the sextant.

through the telescope properly adjusted) and the fixed reflector at a well' defined object as the sun (holding the instrument horizontally), and then bringing the index with the left hand nearly to the commencement of the divisions, move it gently backward and forward, and if the image of the object pass exactly over the object itself the glass is properly placed. For supposing, as the instrument is held, two visual rays to proceed from the object, one of which passes through the fixed reflector at the edge of the quicksilver to the eye, the other falls on the moveable reflector, and both move in a plane parallel to that of the arc. Then the one falling on the moveable glass must be reflected in the same plane, since this glass is supposed to be perpendicular thereto; and consequently, if the fixed glass be so too, its second reflection toward the eye must also be in this plane, that is, in the same plane with the direct ray. It follows, when the index is put to the proper point, that the image and object will be seen exactly in one, and in moving the index through this point the image will appear to pass exactly over the object. But if the fixed glass be not perpendicular to the plane of the arc, or to the line of direct vision, it is evident that the ray reflected from it can never enter the eye in the same direction with the direct ray, but will rise above or fall below it. The effect will be, that the image, in passing from right to left of the object, will pass below or above it. If this should be the case, the fixed reflector must be inclined towards the place of the eye or from it, by means of a screw, which in some instruments is under the glass, in others behind it, and in others at its side. The screw must be turned gradually, till the image passes exactly over the object.

Third Adjustment, App. 60.

(349.) The visual ray coming from any point of an object viewed with the telescope passes through the centre of the object glass, that is, of the glass at the end of the telescope farthest from the eye; and the sextant is held so that this ray may also pass through the middle point between the wires, when placed parallel to the plane of the instrument. This line should therefore be parallel to the plane of the arc.

Let A and B be two stars, the former of which is viewed through the telescope, and is seen at the middle point between the wires. Let then the image of B be brought to coincide with A, by moving the index along the arc. When this is done, bring the middle point of the upper wire to the star A and the image of B, which will immediately appear to separate; and the same appearance will take place and in the same degree, if the object and image be brought to the lower wire, provided the first line of the vision, that is, the axis of the telescope, be parallel to the plane of the arc. If the separation at the lower wire should not be the same as at the upper, this shows the axis of the telescope not to be properly adjusted. Or the following method will enable the observer to make the adjustment in question. Let the image of B be brought to coincide with the object A at the middle point of the upper wire, and then let the object and image be brought to the lower. Should there be an exact coincidence at this also, it is a proof that the axis is properly situated; if not, the axis is inclined to the plane of the arc.

A and B have been supposed to be two stars in order to give as distinct an idea as possible of the adjustment under consideration. But in fact stars are not objects sufficiently distinct for the purpose. It is usual to make this adjustment, in practice, by means of the sun and moon. When the

moon is at a considerable distance from the sun, as 110° or 120° , bring the darkened image of the sun to touch the moon (see Article for taking distance of sun and moon) at the middle point of the upper wire, both wires being made parallel to the surface of the sextant, and then instantly bring the point of contact to the lower wire. If there be an exact contact at this also, the axis of the telescope is truly adjusted; if not, one of the screws of the double collar, in which the telescope is fixed, must be loosened, and the other screwed up, till the contact is seen as above at both wires.* (See *App.* 61.)

Fourth Adjustment.

(350.) Sometimes, before an angle is taken with the sextant, the image of the direct object is made to coincide with the object itself, when the index stands at zero, the commencement of the divisions. This is done by means of a screw near the fixed reflector, which turns it round an axis perpendicular to the surface of the quadrant. The index is set exactly to 0 or zero on the arc; the observer then looks through the fixed reflector at the direct object, and turns the aforesaid screw, till the object appears single and perfect. There is then no index correction.

This operation is considered as a fourth adjustment of the instrument.

If the fixed reflector be turned round, as explained above, till a distant well-defined object coincides with itself, the index being previously fixed at zero, then the sextant will be in this respect properly adjusted for taking any angle whatever, where the object directly viewed is so far distant, that the rays from it falling on the fixed reflector and the moveable one may be considered as parallel. This is the case with all heavenly bodies, and with all other objects more than half a mile from the observer.

(351.) The object which is usually chosen at sea for making this adjustment is the boundary line of the horizon, that is, the fine line on the sea which bounds the spectator's view. The sextant is held vertically, that is, with the arc downwards, and the observer directs his view through the fixed reflector, so as to see this boundary line distinctly. The index being supposed at zero, he will also see in the quicksilver part of the fixed reflector the image of this line. If the image appear to be an exact continuation of the line itself, so that they both together make one fine circular arc, the adjustment in question is correct. But if not, the observer turns the fixed reflector round by means of the proper screw till this is the case.

If the sea horizon cannot be seen, then the observer must choose a well-defined and distant object at a considerable distance, as a church spire, flagstaff, &c. By making the image coincide with the object itself, when the index stands at zero, the adjustment is complete for distant objects.

As we have remarked above, the sextant adjusted in the aforesaid manner will have no index correction when, in taking an angle with it, the object directly viewed is farther distant than half a mile. When it is nearer, this will not be the case. Either a new adjustment must be made, by setting the index to zero, and by means of the adjusting screw making the image of the object directly viewed coincide with the object itself, or

* In a common quadrant the line of vision is directed through the lower hole to the edge of the quicksilver or through the upper hole to the middle of the transparent part of the reflector.

this coincidence may be made with the tangent screw, which moves gradually the index, in which case the reading off is called the index correction.

On the whole it is found most advantageous to determine the index correction, for the following reason. Turning the adjusting screw too often, and thus altering the position of the fixed reflector, renders this part of the instrument very liable to get out of order, and the adjustment very precarious. Hence, in the use of the best instruments of this kind, observers always prefer finding the index correction; which is done, generally speaking, by making the image of the direct object coincide with the object itself, and reading off the arc, which will be the index correction; additive, if the reading off be *off* the arc, and subtractive, if it be *on* the arc.

For all objects at a greater distance from the observer than half a mile the index correction will be the same, unless the position of the fixed reflector has changed. For objects *within* that distance there will be a new index correction for every different distance.

In applying this instrument to astronomical purposes, as in taking the altitude of a heavenly body, or the angular distance between the moon and the sun or a star, it is necessary to determine the index correction with great exactness, for doing which the following methods are generally made use of.

First Method by the Reflected Horizon.

(352.) Hold the instrument perpendicular to the horizon, and bring by the hand the direct and reflected boundary lines of the horizon, so as to be nearly in the same line. Clamp the moveable radius, and by the tangent screw make one exactly a continuation of the other. The reading off is then the index correction for heavenly bodies or any distant objects; additive if *off* the arc, subtractive if *on* the arc.

The mode of reading off on the arc to the right of zero, or the *arc of excess*, is pointed out in Art. 340. The arc is read off first to the line, next to the *left* of the index. Then the farther space up to the index is known, by considering the extreme significant line on the left of the index plate as the index, and reading back, that is, to the right.

Second Method by measuring the Sun's Diameter.

(353.) Put in a telescope of considerable power and set two wires parallel to the plane of the sextant. Darken the direct and reflected suns by placing the proper dark glasses before each reflector; and make them as nearly as possible of the same brightness,* having at the same time a distinct and well defined edge. Bring the reflected sun by the hand nearly to touch the other on the left (by an inverting telescope apparently on the right); clamp the moveable radius and make an exact contact by the tangent screw at the middle point between the wires. The reading off will be the angular distance of the centres of the two suns, or the sun's diameter. If this be equal to twice the sun's diameter in the Nautical Almanac, there is no index correction for distant objects: if it be greater, the difference is

* Sometimes a dark glass is put on the eye end of the telescope for this purpose; in which case a single dark glass before the fixed reflector will be sufficient. A smaller alteration in the brightness of one of the suns is made by screwing the telescope nearer to or further from the plane of sextant.

the index correction *subtractive*: if less. the difference is the index correction *additive*.

Or, after measuring the sun's diameter, as above, on the arc, bring by the hand the reflected sun to the right of the direct one (by an inverting telescope apparently to the left), and make it touch the other on that side nearly. Then make an exact contact as before, by the tangent screw. If the reading off on the arc of excess, where the index will now be found, be equal to that on the arc, there is no index correction for distant objects; if it be not, take the difference, and half this difference will be the index correction; subtractive or additive, according as the reading off on the arc is greater or less than that on the arc of excess. Should the readings be both on or both off the arc, half their sum will be the index correction; subtractive when *on*, additive when *off*.

Ex. October 13, 1820, sun's diameter measured on the arc of the sextant N°. 84 was 32' 30'', off the arc 31' 50'': required the index correction.

Sun's Semid. in Naut. Alm.	16' 4'' ⁵	Dr. Measured on Arc	. 32' 30''
	2	Dr. Measured off Arc	. 31 50
<hr/>		<hr/>	
Dr. in Naut. Alm.	. . . 32 9	Diff.	. . . 40
Reading off	. . . 32 30		
<hr/>		<hr/>	
Index Corr.	. . . -21	Index Corr.	. . . -20

Of the two foregoing methods by measuring the sun's diameter, the latter is the more correct, since any slight error in making a contact on one side will probably be cancelled by a similar error on the other side.

(354.) In measuring the sun's diameter as above care must be taken to measure the horizontal diameter; that is, the reflected sun must be moved to the right and left of the sun seen directly, and not above and below it. This is done by holding the plane of the instrument at right angles to the vertical diameter of the sun. To make an exact contact of the two suns proceed as follows. Bring them nearly together by the hand, then by the tangent screw move them gradually towards each other. As long as the dark line of the sky can be seen between them they do not touch each other. They should therefore be made to approach each other, till this dark line can only be just perceived; a very slight touch of the tangent screw will then make a contact. To ascertain that they just touch and no more, trace by the eye that part of the circumference of each which lies near the point of contact. If each arc appear perfect and uninterrupted, the two suns do not cut each other; if no dark line can be perceived between them, they are not open; they therefore exactly touch each other. By attending to these directions the observer will soon get a habit of measuring the diameter of the sun correctly.*

* Several diameters may be measured *on* the arc and a mean of the readings off taken. The same *off* the arc. Also the limbs may be placed (by hand before the tangent screw is used) alternately a little open and a little close, so that in making the contact the tangent screw may be turned different ways. Thus a more accurate result may be expected. Too much time, however, should not be taken up in doing this, as the exposure of the instrument to the sun, in some cases might alter the index correction.

Third Method by any distant well defined Object

(355.) When neither of the above methods can be used, any well defined object more than half a mile from the observer must be selected, as a church spire, a flagstaff, a star, &c., and the image must be made to coincide with the object. The reading off will then be the index correction for distant objects.

Method of finding the Index Correction for near Objects.

(356.) When, in taking an angle with the Sextant, the object viewed directly is less than half a mile distant, the index correction must always be found by making the image of that object coincide with the object itself. The reading off will then be the correction required.

Having thus explained the construction and necessary adjustments of the instrument, we shall next describe more particularly the nautical observations made with it.

To observe the Sun's Altitude at Sea.

(357.) To take the sun's altitude at sea, first place a dark glass before the moveable reflector. Estimate the altitude by the eye* and set the index by the hand to this altitude. Look from the place of the eye through the middle of the transparent part; and direct the view to that part of the horizon where an imaginary circle of altitude passing through the sun may be supposed to cut it, holding at the same time the instrument in a vertical position. Then, if the arc to which the index is put be nearly right, by vibrating the instrument slowly round the line of vision the reflected sun will be seen near the horizon. Should that not be the case, try a little above or below the horizon till the sun is found, and then by hand bring the lower edge or limb of the sun to touch the horizon, or very nearly so, at one point only. Clamp the moveable radius, put in the telescope, set the wires parallel to the plane of sextant, and make an exact contact; immediately vibrating the instrument, and thus making the image describe a circular arc, which should fall above the horizon, except at the aforesaid point. If an inverting telescope be used, the horizon will appear to be above the sun, and the arc thus described below it.

Either after the altitude is taken, or before, the index correction for the instrument is determined by measuring the sun's diameter, or by the boundary line of the horizon (Art. 352). Or, if the observer prefer making the adjustment, he does it before he takes the altitude, by setting the index to zero, and bringing the reflected horizon into the same line with the direct horizon by the adjusting screw: there is then no index correction.

To observe the Moon's Altitude at Sea.

(358.) The moon's altitude is observed in the same manner as the sun's, when the lower limb is illumined; excepting that it is not always necessary to place a dark glass before the moveable reflector. The ob-

* Or, holding the instrument vertically and the index near 0, and putting dark glasses up, look through the fixed reflector at the sun, and then moving forward the index, bring the image of the sun down to the point of the horizon (as nearly as can be estimated) immediately below it: then, removing the dark glasses from the fixed reflector, make the sun's L. L. just touch the sea horizon on turning the sextant round the line of vision, as explained above.

server directs his view either through the middle of the transparent part of the fixed reflector, or just over the edge of the quicksilver, as appears most advantageous.

When the lower limb of the moon is not illumined, the image of the upper limb must be made to touch the horizon at the point found by vibrating the instrument. In this case, the moon's semidiameter must be subtracted, in deducing the apparent altitude of the centre from the observed altitude of the upper limb.

To observe the Altitude of a Star.

(359.) As a general rule, it is best to bring the index nearly to zero by hand, then holding the sextant vertically, to direct the view to the star from the place for the eye through the fixed reflector. By a slight motion of the index, the image of the star will be seen in the quicksilver part of the reflector. When this is the case, move forward gently the index, and at the same time follow the image downwards by leaning forward, till it is seen nearly to touch the horizon immediately under the star at one point. Put in then a telescope of small power, which adjust, and make an exact contact. In some cases a plain tube may be used instead of a telescope.

To take the Sun's Altitude on Shore by Reflection from an Artificial Horizon.

(360.) The surface of any fluid, as quicksilver, oil, water, &c. is horizontal. It likewise reflects strongly rays of light. Let an observer be supposed to put a small quantity of quicksilver in a flat dish, and, standing on the opposite side of the dish to that on which the sun is supposed to be, to alter his position till his eye receives reflected rays from the surface of the quicksilver, that is, till rays coming from the sun and falling obliquely on the quicksilver are reflected to his eye. He will then see the image of the sun below the quicksilver, and, since the incident and reflected rays make equal angles with the surface, the depression of the image will be equal to the elevation of the sun; consequently, the angle between the two suns will be twice the altitude of the sun. To determine therefore the sun's altitude, the index is put to twice the estimated altitude; the view is then directed (without telescope) from the place for the eye through the fixed reflector to the sun seen below the quicksilver: the instrument is turned round the line of vision, and if the other image is seen there, it is brought nearly to touch with its L. L. the U. L. of the one below the quicksilver: if it is not seen thus, the observer tries a little above and below the sun under the quicksilver till he finds it; he then brings it to touch nearly with its L. L. the U. L. of the other. He then puts in the telescope, adjusts it to distinct vision, sets the wires parallel to the plane of sextant, and makes an exact contact by the tangent screw at the middle point between the wires. The arc is then read off; the result is twice the observed altitude of the sun's L. L.: correcting this for *index correction*, and then dividing by 2, we get the apparent altitude of the L. L.

By bringing the image down so as to touch with its upper limb the lower limb of the image in the artificial horizon, we should in like manner get the apparent altitude of the sun's U. L.

When an inverting telescope is used, the observation for the L. L. will seem to be that for the U. L., and conversely.

(361.) The artificial horizon commonly made use of is a small quantity of clean quicksilver poured into a shallow rectangular vessel. The surface of the quicksilver rises nearly as high as the edge of the vessel. Over the whole a prismatic cover of glass is placed, like the roof of a house. The rays of light from the sun pass through the cover to the quicksilver, and are reflected through the roof again to the eye. The use of the roof is to keep the wind from disturbing the quicksilver.

(362.) Sometimes water and sometimes oil is used in a similar manner; and sometimes the artificial horizon is made of metal or glass, in which case it is necessary to adjust the surface so as to be exactly horizontal. For this purpose a spirit level is placed on it in the direction of two of its feet, and the bubble is brought to the middle by turning the screws of these feet. It is then placed at right angles to the first position, and the bubble brought to the middle by the other screws. It is afterwards placed in its first position, and the operation is repeated, till the bubble rests in the middle in all positions. We here suppose the feet or surface of the spirit level contiguous to the artificial horizon to be parallel to the axis of the fluid in the level. If it is not, the above criterion can never be established; for although the surface were in fact strictly horizontal, yet in that case, when the level is placed in any position on it, the bubble cannot rest in the middle. The above adjustments, therefore, are made in the first instance, half by the foot screws of the artificial horizon, and half by those of the level; by which means an erroneous position of either is gradually corrected.*

In some cases the artificial horizon is a fine plate of glass, which is made horizontal by being floated in a vessel of quicksilver. From the regularity of its form, it is supposed to sink equally on all sides, and therefore to have its own surface parallel to that of the quicksilver, which is horizontal.

(363.) In the use of the artificial horizon, it is important to prevent as much as possible any motion in the adjoining ground; as the communication of such motion to the fluid used for the artificial horizon would render it impossible to get a good observation. For this purpose the artificial horizon should be put on a piece of ground not easily moved, and no weights should pass near the place. The external air should also be excluded as much as possible both by the glass roof and by other means.

(364.) The interior and exterior surfaces of the glass roof ought to be exactly parallel; for if they are not, rays of light in passing through will

* It is not absolutely necessary to touch the screws on the spirit level at all. Make a fine dot, with a pencil or a pen, at one extremity of the bubble as it stands at first; invert the level, and bring the extremity of bubble half way to the dot by screws that raise and depress the end of level. Make a fresh dot at the extremity of bubble; invert again and proceed as before. Repeat this, till the extremity of bubble rests exactly at the dot in both positions. Then, placing the level at right angles to its first position, bring the extremity of bubble to the dot by screws that raise or depress the end of level. Try the same adjustments over again, and re-adjust, if required, till the extremity of bubble rests at the dot in any position in which the level can be horizontally turned. It will be convenient lastly (though not absolutely necessary) to bring the extremities of bubble to the marks or scratches on the glass (or so as to be equidistant therefrom) by the screws on the spirit level itself. If a scale is attached to the level, the extremities of bubble may be thus brought so as to be equidistant from middle of scale.

be bent so as to fall on the artificial horizon at an angle different from what they would have done without the roof. After reflection also, in rising to the eye, they would, from a similar cause, undergo a similar deviation. By inverting the ends of the cover in a second observation, that is, by placing that side towards the observer which was before towards the object, an error of the opposite kind will be introduced. A mean of the two readings off therefore will be more nearly right than either of them singly.

To observe the Sun's Altitude by means of an Artificial Horizon, with a Sextant fixed on a Stand.

(365.) A stand for the sextant is a small brass pillar mounted on three feet, in each of which there is a screw to raise or depress it. The instrument, by a hole in the handle, is mounted on a pivot at the top, which pivot may be made to turn horizontally round its own axis, or vertically round a horizontal axis. The pivot enters the exterior surface of the handle of the instrument, and is clamped by a screw on the other side. The instrument, by the two motions which it has, is then brought into the position in which it is wanted. It is made to rest horizontally on the top of the pillar, or vertically by the side of it; in which latter case two weights, which move with it, are brought to the opposite side of the pillar, as a counterpoise to its weight; or it is placed obliquely to the horizon, in which case the counterbalancing weights are also used. In the observation under consideration the artificial horizon, roof, &c., being adjusted, the stand is placed before it, so that the image of the sun reflected from the artificial horizon may be seen distinctly, first without the telescope, through the fixed reflector in the middle of the fluid or metal surface; the instrument being at the same time placed at the side of the pillar, as nearly as can be estimated perpendicular to the horizon.

The index is then set to twice the estimated altitude of the sun, and the dark glasses placed before the reflectors. Keeping the sun reflected from the artificial horizon still in view, the instrument is turned slowly round the line of vision, till the sun reflected from the glasses is seen near the other. If it is not thus seen, the place of the index must be altered till it is. When the two images are thus seen nearly together, bring that which is reflected from the glasses (which may be known by its moving when the index is moved) near the other, leaving only a very small space between the limbs. Screw the telescope into the collar, and adjust it so that the two images may be seen through it with the greatest distinctness, placing at the same time the wires perpendicular to the horizon. Alter the dark glasses till the two images are of equal brightness and also well defined. Sometimes a small dark glass is fitted to the eye end of the telescope, which darkens both the images; in this case the dark glasses may be removed from the reflectors, with the exception of one before the fixed reflector, which may probably be found necessary in order to render the darkened images of equal brightness. It must be noticed also that a slight alteration in the relative brightness of the image may be made by raising or depressing the telescope parallel to itself, by a screw underneath the instrument; by raising the telescope it is pointed more to the transparent part of the fixed reflector and less to the quicksilvered part, by which the direct image is rendered something brighter, and the one reflected from the glasses something fainter. Bring the moveable image

exactly above the other, and at a short distance from it; if the telescope invert, it will appear below. This may be done most correctly and expeditiously by one of the foot screws, which with that view ought to be set, in the first place, two in the line of the artificial horizon and one to the right or left, by which last the sextant is inclined gradually to the right or left, and this adjustment made.

The images of the points to be brought in contact being thus seen in the middle of the field of view, at equal distances from the wires, the index is clamped, and an exact contact made by the tangent screw.

The images may then, if necessary, be made to touch on the other side; or the observer may wait till by the rising or falling of the sun this contact on the other side takes place without moving the index.

The altitude of the moon's upper or lower limb is observed with the sextant placed on a stand in a similar manner.

To observe the Distance of the Sun and Moon.

(366.) Put a dark glass before the moveable reflector, and set the index by the hand to the distance estimated, or the distance given in the Nautical Almanac.* When the moon is on the left of the sun, with the face of the instrument upwards, otherwise with face downwards, direct the view, without the telescope, through the fixed reflector to the moon, holding the plane of the instrument so as to pass nearly through the sun and moon. (See note, Art. 342.) Vibrate the instrument slowly round the line of direct vision, and the image of the sun will be seen near the moon. Move the index by the hand, so as to make the image nearly touch the moon; then clamp the index. Screw in the telescope, adjust it to distinct vision, placing the wires at the same time parallel to the plane of the sextant. Alter the dark glasses, and elevate or depress the telescope by the screw underneath the instrument, till the image of the sun is of equal brightness and distinctness with the moon seen directly. While the observer is thus preparing to take the distance, two others are usually preparing to take the altitudes, one that of the sun, and the other that of the moon. All of them being ready, the principal observer, after resting his arm and eye a short time, directs his view through the telescope to the moon, and turning the instrument slowly round the line of vision, brings the image of the sun into the field of view. By the tangent screw he makes the image of the sun just touch the moon at the middle point between the wires, and the altitudes are taken at the same instant. The exact contact is known by the disappearance of the dark line of the sky between them, and by the edge of each being at the same time perfect.

The readings off on the different instruments are then put down, and a second set of observations made in the same manner. The distance is this time taken by unclamping the index plate, and moving with the hand the image of the sun on the moon; that is, it is first moved so as to cut the moon by the hand, and then the tangent screw is turned till there is a contact again. This will, in some measure, correct any error in the moveable radius, by which it is bent without turning the moveable reflector. If necessary, several pairs of observations are thus made, and a mean of the

* Or, putting dark glasses before the reflectors, bring the image of the sun up to the moon, by moving forward the index; and then remove the dark glass from the fixed reflector.

whole taken ; but it must be considered that after two, or at farthest three observations, the arm of the observer as well as his eye becomes a little fatigued. It is a question, therefore, whether the observation upon the whole does not become rather vitiated than improved, by taking a very great number of distances at the same time.

When the altitudes of the bodies are not taken, it is necessary to note the time by a watch when each distance is observed. The mean of all the distances will then be the distance corresponding to the mean of all the times.

To take the Distance of a Star from the Moon.

(367.) If the star is to the left, the instrument is held with its face upwards, and the view directed through the fixed reflector to the star. The index is set to the estimated distance, or to the distance taken from the Nautical Almanac, as in the case of the sun and moon, and the contact is nearly made without a telescope.* Then, having put the telescope in its place, and adjusted it to distinct vision, with the wires parallel to the plane of the instrument, an exact contact is made by means of the tangent screw, at the middle point between the wires. If, on vibrating the instrument slowly round the line of vision, immediately after making the contact, the star appears on the face of the moon or wholly off it, in that case the contact is not exact. The tangent screw must be used, till the star on this vibration passes the edge of the moon, so as to be seen partly on it and partly off, the edge of the moon appearing to bisect it. Proceed then as in Art. 366.

If the star is to the right of the moon, the face of the instrument is turned downward ; the contact is made by the same steps as before.

Causes of Error, and Cautions to be observed in the Use of Sextant.

(368.) Although the greatest possible care is taken in the construction and adjustment of the sextant, yet there are causes of error, which it is difficult altogether to remove. It is necessary therefore that the observer should be aware of them, in order that, in the first place, he may choose an instrument as perfect as possible, and, in the next place, that he may preserve the instrument in that state.

Parallelism of the Surface of the two Reflectors.

(369.) If the fore and back surfaces of the reflectors are not parallel, the images reflected therefrom will not coincide, so as to form one single perfect image ; but the images will be separated from each other, at least sufficiently so to make the image, which is seen, confused. Before therefore an instrument of this kind is bought, the seaman should carefully examine the glasses as follows. Place the eye near the reflector, so as to look very obliquely into it and to see therein the image of a distant well defined object. If the image be single and well defined, the surfaces are parallel ; but if two images are seen, or rather if the single image be badly defined and obscure about the edges, in that case the surfaces are inclined to each other, and the instrument defective.

* Or the image of the moon is brought up to the star by moving the index on the arc.

The Surfaces of the Reflectors should be plane.

(370.) In the theory of the sextant, the surfaces of the reflectors are supposed to be plane. To ascertain whether they are so or not, observe in the usual manner the angle between two distant well defined objects, which are nearly on the same level, and bring the image of the right hand object to coincide with the left hand object seen directly at the edge of the quicksilver, so that the image and object may appear to move along the edge of the quicksilver. If they continue coincident, the surfaces are plane; but if they separate from each other, the surfaces are not plane. In making this experiment, care should be taken not to alter the position of the plane of the sextant, that is, not to turn it round the line of vision; since, by such a motion, the image would be at once separated from the object, although the surfaces under consideration were perfect.

Form of the Dark Glasses.

(371.) The surfaces of the dark glasses should be plane, and parallel to each other, for if they are not rays of light in passing through them will have their direction altered, and consequently an object or image seen through them would appear in a different place from what it would independently of these glasses. There are two ways of examining the correctness of their form. The first is, to put a piece of dark glass on the eye tube of the telescope, and then to make the image of the sun touch the sun seen directly. When this is done, take off the dark glass from the eye end of the telescope, and put different combinations of the dark glasses before the reflectors. If the contact remain perfect, the surfaces of the dark glasses used may be considered as parallel; if not, they are inclined to each other. The second method is to measure the sun's diameter carefully both on and off the arc; do this with different combinations of dark glasses. Then if the sum of the two diameters, so measured, be equal, or very nearly equal, to four times the semidiameter in the Nautical Almanac, there can be no great error in the form of the dark glasses.

The True Circular Form of the Arc, and the True Centering.

(372.) The arc of a Sextant should be exactly circular; otherwise it cannot measure half the angle round which the moveable radius is turned. Also the centre of this circular arc should be in the axis, round which the radius is turned as the index is moved forward. These, however, are adjustments which cannot be accurately proved by any common method practicable to seamen. If the index be moderately clamped, and then moved along the arc by the hand, the equability with which it yields to the pressure forward, and the smoothness of its motion will form some criterion of the correctness of the adjustments in question. Beyond this, the seaman must depend on the care and skill of the instrument maker.

Bending of the movable Radius.

(373.) When in taking an angle, the index plate is clamped, and then gradually moved by the tangent screw, the radius thus pushed forward is liable to bend, so that the place of the index on the arc is not an accurate criterion of the position of the moveable reflector.

To determine whether or not an instrument is imperfect in this respect, bring the image of the sun by hand nearly to touch the direct sun,

leaving between them a very small opening. Then clamp the index plate, and observe carefully, whether or not, on turning the tangent screw either way, this opening varies, that is, is increased or diminished. If it does not, this circumstance must be owing to the bending of the radius without affecting the glass; in which case the instrument is defective.

To obviate any error of consequence likely to occur, from the above-mentioned causes, in observing any angle between two objects, it is advantageous first *by the hand* to bring the image a little short of the object, and then to make a coincidence or a contact, by the tangent screw; and afterwards, having noted down the first reading off, to unclamp the index plate, and again *by the hand*, to move the image a little beyond the direct object, and by the tangent screw to bring the image back to the object.

Thus, if the radius be bent, it must be bent different ways, in the two cases, and the errors arising therefrom in the angles read off will tend to cancel each other.

Or, with a similar view of correcting any error produced by the bending of the moveable radius, the observer may determine the index correction by measuring the sun's diameter only on the arc (353), and then, afterwards in observing an angle, by taking care to move the tangent screw the same way he did before. For thus the error in the index correction will tend to cancel the error in the angle read off.

The above remarks will, in some measure, enable a seaman to examine a sextant previous to purchasing it. They tend also to show him what great difficulty there must be in constructing a good instrument of this kind, and the care requisite in the use of it. If he has by him an instrument whose accuracy he has ascertained, he will beyond doubt compare any new one with this, and such a comparison will enable him to form the most correct estimate of its goodness; but as this is not likely to be often the case, he must go through the different points of examination in the manner pointed out above.

The Reflecting Circle.

(374.) The instruments first constructed by Hadley were called *quadrants*, from the circumstance of their being constructed to measure an angle of about 90° at most. Instruments exactly on the same principle were soon made to measure angles as far as about 120° , the arc being about half this or 60° (335): these have by way of distinction been called *sextants*. Every direction which can be offered respecting the adjustment and use of one is applicable to the other; as they differ in nothing but the name, and the extent to which they measure angles.

But there is another instrument of this kind, called a *reflecting circle*, concerning which it is proper in this place to make a few separate observations, as the use of it is in some essential points different from that of the sextant. Indeed it is a very superior instrument to either, and claims the particular attention of the seaman.

Suppose the arc of a sextant to be continued quite round, so as to form an entire circle; the reflectors and place for the eye or telescope either remaining as before, or, if necessary, being changed; taking care only that lines from the place of the eye and from the moveable reflector at the centre of the arc, to the fixed reflector, should make equal angles therewith; which is all that is indispensably necessary in their position (335). When the two reflectors are parallel, let the index stand at 0 or

nearly at 0. Then in taking an angle, the index, as in the sextant, is pushed forward, being first moved by the hand and afterwards by the tangent screw, till the image is made to coincide with or to touch the object seen directly. After this is done, the index may be brought back to 0, and moved on the continuation backward of the arc, by which movement the central reflector must be turned from its parallel position the opposite way to what it was before. Let it be thus carried back to the same angle from the parallel position that it stood at before *on* the arc; and then let the circle be turned round the line of vision, so that the reflectors may be downwards. By this inversion, the index and the reflectors will be brought into the same relative position they had when the image and direct object were together before. Consequently they will be so again.

By taking the angle between two objects therefore in the usual way, and by then inverting the instrument and taking it again, we get two observations and two readings off. But there will be a much greater advantage in this, than the simple multiplication of observations or readings off. For, in the first place, the dark glasses which may be used, by the inversion of the circle are also inverted; and if their surfaces be inclined to each other instead of being parallel, the direction of the inclination is thus changed; consequently the effect on the angle measured will be of a contrary kind, that is, if it increased the angle before, it will now diminish it as much. Again, if the commencement of divisions one way be erroneous, it will now be as far wrong the other way, diminishing the angle read off in one case as much as it increases in the other. The mean of the two readings off will therefore be the true angle between the objects, independent of the errors of dark glasses or index correction.

These advantages alone are sufficient to give the reflecting circle a decided advantage over the sextant, however accurately the latter may be constructed. But it has much greater advantages than these.

We have mentioned hitherto but one moveable radius, by which the central glass is turned round; but in fact there are three, at equal distances from each other on the circumference. They are all attached to the central reflector, and are carried round with it, through equal angles. Each moveable radius also carries an index and an index plate; so that, whenever an angle is observed, there are three readings off on different parts of the arc. The divisions indeed are numbered only for one reading off; but this is of no consequence, since, having got the degrees from this, we want only the minutes and seconds on the other.

By having these three readings off, and taking a mean of them, we get a compensation for any slight errors in reading, as well as in the divisions themselves. And should the form of the arc have got warped, or undergone any slight alteration in its form, it is manifest, that one reading off will tend to correct another. This will be the case also, if the axis round which the radii are turned should be out of the centre of the circle; since, although an arc on one side may be greater than the angle at a point out of its centre, the arc on the other side will be less than it.

It appears therefore that in using the reflecting circle we have no mistakes of consequence to apprehend from the imperfect form of the dark glasses, from the errors of division, from the warping or misformation of the arc, or from the misplacing of the axis of the instrument; all which causes of error operate more or less in the very best sextants. If this instrument therefore be constructed with care, it must manifestly give great confidence to the seaman in the result of his observations.

Use of the reflecting Circle.

(375.) The use of the reflecting circle differs in nothing from that of the sextant, as heretofore explained, except that when an angle is taken with the reflectors upwards, the index being moved from right to left, the index is brought back to zero, and then the instrument being inverted or the reflectors placed downwards, it is pushed again from right to left, and the angle thus repeated. The readings off are three in each case, and the mean of the six is the true angle. The manner of holding the instrument will be evident on seeing it, and need not be explained here.

When the circle is used with the stand, it is screwed on the top thereof, first with the reflectors upward, and then with them downwards.

The adjustments of this instrument are the following. The two reflectors must be set perpendicular to the plane of the arc. This is done in the same manner as for the sextant. The image of the arc seen in the central reflector must be single and well defined; by this means the surface of the reflector is proved to be plane and also perpendicular to the arc. The image of a well defined object, on moving the index slowly through zero, must pass exactly over the objects seen directly (348). The line of vision must be parallel to the plane of the arc, and if a telescope is used (which is generally the case), its axis must be brought parallel thereto as explained in Art. 349. Lastly, if the observer, in any case, should only be able to get the angle with one face of the instrument upward, he must determine and apply the index correction as for the sextant.

Theodolite.

(376.) A theodolite is an instrument by which may be measured either the angle of elevation of any object above the horizon, or the horizontal angle between any two objects. In a telescope are fixed two wires at right angles to each other, which are distinctly seen through the eye glass. One wire is made horizontal by adjustment, and the other vertical; the straight line joining the intersection of these wires and the centre of the object glass is considered as the axis of the telescope, or the line of vision. This line of vision is directed to an object A, so that A is seen at the intersection of these wires. The place of an index on a horizontal circle is then noted, and also the place of another index on a vertical circle, by which latter is known the elevation of A. The line of vision is then directed to B, and the two readings off are again noted down, of which the latter, as before, is the elevation of the object viewed; the difference of the horizontal readings off is the horizontal angle between the objects.

(377.) In order to adjust the instrument so that the arcs traversed by the axis of the telescope may be thus exactly known, it is necessary to proceed as follows. In the first place the stand on which the instrument is mounted must be securely and firmly fixed, and at the same time placed in such a manner, that the plate at the top may be as nearly horizontal as can be estimated by the eye.

The instrument consists of a horizontal brass circle, and another circle or part of one placed vertically over it. The first adjustment is to make the former revolve in a horizontal plane, as it is turned round the central axis on the stand, for which purpose a spirit level is fixed or hung on so as

to revolve with it. The circle is turned round till this level is parallel to two screws, by which the circle can be raised on one side and depressed on the other; and by easing one screw and screwing up the other, the bubble is brought into the middle. The circle is then turned round till the level is reversed, end for end; that is, till the end that was to the right is on the left. If the bubble does not rest, as before, in the middle, it is brought half way by the screws under the circle in the direction of which the level is placed, and half way by the screws at the ends of the level itself. Then, by turning the circle, the level is brought into its first position and adjusted if necessary as before. Repeat this operation till the bubble rests in the middle in both positions. The axis of the level is thus rendered parallel to the circle (see note Art. 362).

Next turn the circle, so that the level may be at right angles to its former position, and, if necessary, by means of the screw or screws which raise the circle, bring the bubble to the middle; and afterwards try it all round, altering the adjusting screws of the circle, till it remains exactly in the middle, in making an entire revolution.

If there is a second spirit level on the circle, at right angles to the first, the bubble in it must be brought to the middle, when the above adjustments are completed, by means of its own screws.

The surface of the horizontal circle is now truly horizontal, and the bubbles in the two levels will be a criterion of its remaining so, at least for a short time. If either of the bubbles move from the middle, it must be brought back again by the adjusting screws of the circle. It may indeed be supposed, that the axis of each bubble is parallel, or nearly so, to the circle, before the above adjustment is begun. And upon this supposition, the bubbles are generally first brought to the middle by the screws raising or depressing the circle, and then tried by the method described above. This will often save a good deal of trouble, and the adjustment be thus made without turning the screws at the ends of the levels too much (or see note, Art. 362).

(378.) The circle being horizontal, if the axis of a telescope coincided with any of its diameters, it is manifest that, the edge being graduated and turning past a fixed index, the difference of two readings off would be the horizontal angle between any two objects to which the telescope may have been successively directed.

The same will be true, if the axis of the telescope be situated above the circle, anywhere in a plane perpendicular to it and passing through its centre. Now this is the case in a properly adjusted theodolite. A telescope is fixed over the horizontal circle, being attached to a vertical circle, or part of a vertical circle, which is intended to show through what angle the axis of the telescope may have been traversed perpendicular to the horizon; the before-mentioned circle showing at the same time through what angle it has been made to traverse horizontally.

The telescope rests in two collars, of which the middle points are in a straight line, lying in a vertical plane that passes through the centre of the horizontal circle. One adjustment of the telescope is therefore to bring the line of vision so as to pass through these central points. Another adjustment is to render the same line of vision truly horizontal, when the index past which the vertical circle turns stands at zero. For these adjustments being made, it is manifest, while the index on the horizontal circle points out the horizontal angle traversed by the axis of the telescope or line of

vision, that the index of the vertical circle will show the angle traversed by it in altitude.

(379.) To adjust the line of vision so as to coincide with the middle line of the collars in which the telescope rests, direct the telescope, so that some distant well-defined object may be seen at the intersection of the wires. Then turn the telescope round in the angles supporting it, so that the part underneath may be above; and if the object be still seen at the intersection of the wires, the adjustment is correct; if not, bring the said intersection half way to the object by easing one of the screws on the telescope which translates the wires, and screwing up the other. Afterwards find a new well-defined object, and repeat the operation till the intersection cuts it in every position of the telescope in the collars. The axis of the telescope is thus supposed to be brought into the vertical axis of the instrument, that is, the axis round which it is turned horizontally.

(380.) To find the place of the index on the vertical arc or circle, when the axis of the telescope is exactly horizontal, bring the bubble of the level* attached to the telescope to the middle, by giving the vertical arc a motion round (at last very gradually by tangent screw); invert the spirit level, and if the bubble still rest in the middle, the necessary adjustment is made; if not, bring the bubble half way to the middle by the tangent screw to the vertical arc, and half way by the screws on level: invert again, and repeat till the adjustment is exact. If then the reading off on the vertical arc be nothing, zero is right, and there is no index correction; if not, the reading off must be considered as an index correction. †

The adjustment of the instrument may be now considered as exact, and either horizontal angles or vertical angles may be taken with it as follows. The telescope is directed to an object A, so that the intersection of the wires may be exactly upon it. The arc on the horizontal circle is then read off, and also that on the vertical circle. Afterwards, the telescope is, in a similar manner, directed to B, and the two corresponding readings off noted down. The readings off on the vertical circle corrected for index correction will be, respectively, the elevations or apparent altitudes of the objects above the level of the axis of the telescope when horizontal; the difference of the readings off on the horizontal circle (or the sum, if different ways) will be the horizontal angle between A and B.

(381.) In some instruments the index may be set to zero on the horizontal circle and clamped; and then the whole head of the instrument turned round till the axis of the telescope is pointed to A. The head is then clamped firmly, and the horizontal circle turned round till the telescope is pointed to B. Thus only one reading off on the horizontal circle becomes necessary, which is the horizontal angle between A and B.

Usually there is a magnetic needle on the horizontal plate. The index being set at zero or 360° on the horizontal circle (which zero is in the

* If the level on or attached to the horizontal circle be not sufficiently sensible, make the adjustment of the horizontal circle by means of the level attached to the telescope; using the elevating screws to the circle and the tangent screw to the vertical arc.

† This index correction is more exactly determined by observing with the instrument the altitude of the same object with face of the vertical arc first right and then left. Half the difference of the readings off is the index correction.

direction of the north and south line on the card), the whole head is turned round till the north end of the needle coincides exactly with the north end of the card. In this situation, therefore, the index, and consequently the line of vision of the telescope, is pointed to the magnetic or compass north—and on its being pointed to any other object, the horizontal index will show its bearing reckoned from the compass north.

Moreover, if the index be set to zero, and then the head turned round till the axis of the telescope is directed to the true north or south, the reading off afterwards, when pointed to any object B, will be the true bearing of B. The place of the index on the horizontal circle, when the axis of the telescope is pointed due north or south, may be found either by bringing the middle vertical wire into the meridian in the manner described in the articles on the portable transit, or more easily as follows. First see that the theodolite is in every respect adjusted. Then when a bright star is at least three or four points of true bearing from the meridian, point the telescope to it; and make the horizontal wire bisect the star at the middle point. Preserving the instrument from any motion or exposure that could affect the adjustments, when the true bearing of the star is nearly the same to the west of the meridian as it was before to the east, move the horizontal circle round, and thus (without touching the vertical circle) bring the telescope again towards the star, and continue to move the horizontal circle till the star is seen in the field of view. As it approaches the horizontal wire, move the horizontal circle very carefully, so that, in passing the wire, it may pass exactly at the middle point. Then the middle point between the places of the index on the horizontal circles, at the two observations, will be its place when the axis of the telescope is due south or north (see Art. 256).

Frequently in these instruments there is a second telescope underneath; which can either be clamped to the same position, whilst the circle is turned round, or turned round together with the circle. This second telescope is in the first place pointed in the same direction, that is, to the same object, with the upper telescope. Then the latter is turned round to a second object, independently of the former; and when the intersection of the wires is brought to the second object, the under telescope is examined, in order to ascertain the steadiness of the instrument during the observation.

Portable Transit Telescope.

(382.) By a transit telescope is meant a telescope having a vertical wire across the axis or line of vision, so adjusted that when the whole is made to revolve round a transverse axis, by means of lateral arms supported on each side, this wire may move in the celestial meridian. Being thus adjusted, it is manifest, when a heavenly body is seen to pass the wire, that it is on the celestial meridian.

A second wire is placed at right angles to the one above mentioned; and the line joining the intersection of the two and the centre of the object glass is the axis or line of vision.

The telescope, as has been just observed, is supported by means of lateral arms, which rest on the tops of pillars in grooves or angles. These pillars are secured and rendered firm in various ways, as may seem most effectual and convenient. By means of a screw under one of the angles, or by means of the screws at the feet of the frame-work, this angle may be

elevated or depressed gradually. By means of another screw acting immediately upon it, it may be pushed gradually in a horizontal direction. It must be observed also, that the ends of the arms which rest on the supporting angles are made exactly round and equal.

(383.) To adjust this instrument, so that the axis of the telescope and the vertical wire may revolve in the meridian, the stand is first placed on a firm pediment, in such a position that the transverse line joining the middle of the two angles, in which the lateral arms of the telescope rest, may appear horizontal, and directed as nearly due east and west as can be judged by a compass corrected for variation. The lateral arms of the telescope are then placed in the angles, and the bubble of the spirit level, which is either attached to the transverse arms or mounted on its cylindrical ends, is brought to the middle, that is, to two marks on the glass equidistant from the middle point. The level is then inverted, the right hand end to the left, and the left hand end to the right. If the bubble does not rest in the middle, it is brought thither, half way by the screw elevating one of the supporting angles, and half way by the screws belonging to the level itself.* The level is then again inverted, and the bubble again brought to the middle as before. This operation is continued till the bubble rests very exactly in the middle, or at the same marks, in both positions of the transverse axis.

By this adjustment the transverse axis, that is, the line joining the middle points of the cylindrical ends round which the arms turn, is made truly horizontal.

(384.) Next, the telescope is turned round till a fine object is seen on the middle vertical wire. Then slowly turning the telescope, it is observed, whether or not the object continues on the middle wire. If it does, the wire is thus proved to be exactly vertical. If not, the wires are turned round in their socket, the screws which hold this socket in its place being first loosened, till a well-defined object appears, by proceeding as above, to run exactly along the wire. The socket of the wires is then screwed fast.

The telescope is now again turned round, till some distant well-defined object is seen exactly at the intersection of the middle wires. The transverse axis is then inverted, with respect to the angles supporting it, by which movement the telescope is made to revolve round its own axis. If therefore the intersection be still exactly on the same object as before, it is a proof that this intersection is in the said axis; which is the adjustment required. But if not, bring the intersection of the wires half way to the object by the screws on the telescope which move the wires horizontally; taking care to loosen one before the other is tightened. Invert the arms again, and proceed as before; and repeat the operation till the intersection of the wires continues on the same object.

It may be proper after this to try all the adjustments, hitherto mentioned, over again; making any slight alterations which may be necessary. The intersection of the wires now moves in a vertical circle, as the telescope is turned round the transverse axis between the lateral supports. The next thing is to cause it to move in the meridian.

* See note, Art. 362.

(385.) From an altitude of the sun, taken either from the sea horizon, or by means of an artificial horizon, and the time by the chronometer taken at the same instant, find the error of the chronometer on mean time, and knowing its rate nearly, compute the hour, minute, and second it will show when the sun's centre is on the meridian; and then, by applying the interval of the semidiameter's passage taken from the Nautical Almanac, find the hour, minute, and second when the eastern and western limbs of the sun pass. As this time approaches, direct the telescope to the sun, taking care to guard the eye by a dark glass. Prepare the adjusting screw for use, which turns one of the angles supporting the lateral arms horizontally. When the sun is seen in the field of view through the telescope, turn the said adjusting screw, so as to make the first or western limb touch the central wire, at the instant the chronometer shows the computed time. Do the same still more exactly, when the last or eastern limb passes.

The same approximation to the meridian may also be made by computing the time shown by the chronometer, when a bright star passes the meridian, and bringing the wire to bisect it, when this time is shown.

The nearer the star by which this adjustment is made is to the pole of the heavens the better; since its motion is more slow, and a slight error in the computed time of its transit will be of less consequence.

The next step is (if necessary) to bring the middle wire *exactly* into the plane of the meridian.*

By a Star near the Pole.

(386.) Try all the adjustments over again, and make them correct, if they are not so. When a star near the pole of the heavens passes the meridian (that is the wire of the telescope), either above or under the pole, note the second shown by the chronometer, supposed according to Gr. M. T. After an interval of nearly 12 hours, again note the time of its passing under or above the pole. Correct the interval of the transits for the rate of the chronometer, and if the result be $11^h 58^m 2^s$, the axis of the telescope is exactly in the meridian. If less than this, by the adjusting screw move one of the lateral arms horizontally a little, so as to increase the interval; if greater, shift it so as to make the interval less. Repeat the observations and alterations till the resulting interval is exactly $11^h 58^m 2^s$.

If the chronometer used be a sidereal one, the interval corrected for the rate should be 12 hours.

In order to move the wire by the horizontal adjusting screw very gradually, a well-defined object cut by the middle wire, when near the meridian, must be noted; or if there be no object of this kind in the range of the telescope, as it is turned round, one must be put up for this purpose. The slightest separation of the middle wire from it will then be perceptible.

By the Transit of Stars differing much in Declination.

(387.) Note carefully the hour, minute, and second shown by the chronometer when two bright stars pass the middle wire, one of which

* If the object of the observer be merely to determine the rate of his chronometer from repeated transits of the same heavenly body, as the sun, in that case the approximation to the meridian found above will be sufficiently near for the purpose.

stars is as near the pole of the heavens as possible, and the other as far from it as possible. The apparent right ascension of these stars may be taken at once from the Tables (see *Naut. Alm.*). Subtract the less right ascension from the greater, and, if the chronometer be regulated to mean solar time, turn the difference into mean time. Call this the true interval of the transits in mean time, which, if the axis of the telescope be exactly in the meridian, will be equal to the interval shown by the chronometer corrected for the rate. If it be not, in that case one of the angles supporting the lateral arms must be moved a little horizontally, and a second trial made by other stars the same night, or by the same stars as before on the following night. If the chronometer or clock show sidereal time, the difference of right ascension must be used as it is.

If the southern star pass the meridian wire *too soon* for the computed difference of right ascension, the telescope when pointed to the south is to the east of the true meridian. If the southern star pass the wire *too late*, the telescope when directed south is to the west of the true meridian. And this is true, whether the southern star pass the meridian before or after the other; it is true also either in north or south latitude. By attending to this, the observer will know in what direction to move the arm of the telescope by the adjusting screw, in order to bring it gradually into the meridian.

(388.) When the middle wire is made thus to revolve in the meridian, all the adjustments being at the same time perfect, it is proper to select some mark which the wire covers or touches, or to put up a mark for this purpose at the distance of at least five or six hundred yards. This is called a meridian mark, and enables the observer always to detect any error in the position of the telescope, and to rectify it.

The middle wire of the telescope being now supposed to revolve accurately in the meridian, we shall say a few words on the mode of taking the transit of different heavenly bodies.

To take the Transit of the Sun.

(389.) When the sun comes near the meridian, point the telescope towards it: as soon as it is seen in the telescope, adjust the eye-glass, so that the sun and the wires may both be seen distinctly, a dark glass being previously placed before the eye. When the western limb of the sun is near the meridian wire, observe the second on the clock by the eye, and then count the additional beats by the ear, till this limb touches the wire, at which instant note the second and decimal fraction of a second.* Mark this down with the corresponding minute and hour, and wait till the eastern limb approaches the wire. Take the transit of this in a similar manner. The mean of the two times so noted down will be the time when the sun's centre is on the meridian.

We have here supposed only one vertical wire to be placed before the eye-glass. But there are generally three, the middle one or meridian wire, and one on each side of this, at equal distances from it. The transit of each limb of the sun is taken at every one of these wires, by which means the accuracy of the transit over the meridian is greatly increased. When the sun comes into the field of view of the telescope, the transit of

* When a chronometer is used, the second may be noted by an assistant.

the western limb is taken at the first, second, and third wires, and then the transit of the eastern limb at the same wires, in succession. The mean of the transit of the western limb at the first wire, and that of the eastern at the last wire, also the mean of the transit of the eastern limb at the first wire, and the western at the last, is the time of the centre's passing over the middle wire. The mean of the transits of the two limbs over the middle wire being added to the other means, and the sum being divided by 3, the result is the correct time of the transit of the centre over the meridian.

When the meridian transit of the sun or a fixed star has been observed, and the time at the same instant taken by a chronometer, the error of the chronometer on mean time, or sidereal time at the place (see Art. 204), may be easily deduced.

To take the Transit of a Planet.

(390.) The transit of a planet is observed in a similar manner by noting the time of the appulse of the first and second limbs to each of the wires, and taking a mean, supposing both limbs to be visible. If not, proceed as for the moon.

To take the Transit of the Moon's Enlightened Limb.

(391.) The transit of the moon is observed by noting the time by the clock of the appulse of the enlightened limb to each of the wires, and taking a mean of all the results. This mean is the time of the transit of the enlightened limb over the meridian.

To take the Transit of a Fixed Star.

(392.) A transit of a fixed star is observed by noting the time shown by the clock when it passes over each wire, and taking a mean of the results.

(393.) To set the telescope to any particular polar distance, a fixed graduated arc is sometimes placed at the extremity of one of the transverse arms on which a radius with an index is moved as the telescope is turned round. When a star whose polar distance is known is at the intersection of the middle wires, the index is put by the hand so as to show the given polar distance. Then afterwards, when the index is set, by moving the telescope round to the polar distance of any other body on the meridian, the telescope will be pointed to it.

In the night the wires are illumined by a lamp placed at the end of one of the transverse arms of the telescope, which is hollow. The light passing from the lamp down this arm into the body of the telescope is there intercepted by a plane reflector placed at an angle of 45° to the axis, by which it is reflected down on the wires. A hole is left in the middle of the reflector, which transmits the central rays from the object. To proportion the quantity of light to the circumstances of the observation, a piece of coloured glass is interposed between the lamp and the hollow arm of the telescope. When this apparatus is wanting, the telescope and wires are illumined by a lamp placed near the object glass.

Azimuth Compass.

(394.) When a bar of steel has been touched with magnets, it is placed on the under surface of a circular card, the circumference of which is divided into 32 equal parts, called points, which are marked N., N. b. E., &c. (see Art. 29). The bar is fixed in the direction of a north and south line on the card. The card being then balanced on a pin in the centre, is carried round by the magnetic influence of the needle, and assumes a position in which (independently of the variation) the points marked on the card may be considered as indicating the corresponding points on the horizon of the place.

The box in which the card is placed turns on jimbols, so that while a ship rolls or pitches the card itself may remain nearly quiescent and horizontal, the axis of rotation with this view being made to pass through the point on which the card rests. The box also may be turned round the card, the axis of rotation in this case also being made to pass through the same point, namely, the extremity of the pin on which the card rests.

In the inside of the box an index is fixed, which, on turning the box horizontally, is carried along the edge of the card, or rather against a graduated circular rim of metal, by which the card is surrounded. This index has a motion towards and from the card, by which it may be pressed against the card, whenever this is necessary for the purpose of reading off.

(395.) When the azimuth compass is prepared for use, a cross bar is laid across the top of the box, being fitted on its edges. At each end of this bar is a brass stem, in one of which there is a long slit or narrow opening; in the other there is also lengthways a wider opening, down the middle of which runs a fine vertical thread. The observer therefore having fixed these right, and placed the eye at the aforesaid narrow opening in the upright bar, turns round the box, till the object of which he wishes to take the bearing is bisected by the thread; he then pushes the index plate close to the card, and reads off the arc.

The index plate is usually placed 90° to the right of the place where the thread, when produced down, would cut the edge of the card; so that the true bearing of the object is 90° farther to the left than the reading off.

To take the bearing of high objects, the eye is placed at the bottom of the narrow opening, and the object is bisected by the top of the thread; to take the bearing of low objects, from an eminence, the eye is placed at the top of the opening, and the object is bisected by the bottom of the thread. If the elevation or depression be more than 15° , the bearing cannot be taken with any accuracy.

To observe the bearing of the sun, a piece of dark glass is put on the opening at which the eye is placed, and the sun is bisected by the thread; the index plate or stop is then pressed against the card. Or it may be observed more conveniently and accurately thus. Paste a piece of white paper on part of the cross bar, so that the groove which runs along the middle of this bar may be seen at each end of the paper. Then, by turning the box round, throw the shadow of the thread along the middle of the transverse bar, so as at each end of the white paper to fall into the groove. When this is done, push the index plate, gently, close to the card, and read off.

When the bearing of the sun is taken at sea in this manner, it is necessary for a second person to read off at the moment the shadow of the thread

is thrown as described above; since if there were any delay, the ship by altering its course, or by any sudden movement, might change the place of the index on the card. This mode of making the observation is more accurate than stopping the card; for by pushing the index suddenly to the card, a slight alteration is frequently made in the position of the latter; and moreover, when one sight has been taken, the card being freed from the stop, will often oscillate some time before it is again steady. Whereas after reading off without stopping the card, a second observation may be taken immediately, and thus a mean of several sights used for the true bearing corresponding to the mean of the altitudes taken at the same time.

Station Pointer.

(396.) A station pointer is an instrument used in finding the point on a chart corresponding to a place on ground surveyed, from which the angles which one known object makes with two others have been taken. Thus, if the position of each of any three objects A, B, and C is known on the chart, and the observer in surveying has from any station, as *a*, taken the angles between B and A, and B and C; then by a station pointer the spot on the chart corresponding to the station *a* can be at once found.

A station pointer has three rulers, one of which is fixed, and the other two moveable round a central axis, in which the edge of all three meet. The angles through which the moveable edges are turned from the fixed one are measured on a brass circle, described round the same central axis. In the use of this instrument the edges of the moveable rulers are set so as to make the observed angles with the fixed one. The instrument is then placed on the chart, so that the edges of the rulers may pass through the proper objects; that of the fixed ruler over the object from which the angles observed are reckoned, and each of the moveable edges over that object to which it is set. The centre of the instrument is then on the point of the chart required, which is marked by pressing a fine steel point through the opening left in the centre.

When the angles are observed with a sextant, it will generally be necessary to add two angles together, in order to get the greater angle to be set on the instrument the same way.

A station pointer may evidently be used in drawing a straight line to make a given angle with any other straight line at a given point. Set one of the moveable rulers to the angle. Then set the edge of the fixed ruler on the line, and the centre of the instrument on the point in it, from which the required line is to be drawn. In this position of the instrument, a line drawn along the edge of the moveable ruler, and produced to the given point, will be the line required.

Protractor.

(397.) A protractor is an instrument (generally a circle of brass) having its circumference graduated; it is used to set off any proposed angle, that is, to draw a straight line making any proposed angle with another straight line. Thus let AB be any straight line, and let it be required to draw a second straight line making an angle of 30° with AB at the point A. A protractor is placed with its centre on A, and the radius corresponding to the commencement of the divisions on AB; then a dot being made on

the paper at the proposed degree on its periphery: a straight line drawn from A to this dot will make with AB the angle proposed.

A protractor is usually, as we have observed, a brass circle, having its circumference graduated, and an index which moves round it and may be set to any division proposed. A fine point is then pressed down, which makes a mark on the paper: this determines the position of the required line.

In some instruments, by moving the radius round the circle, two indices are carried on its circumference diametrically opposite to each other, and two marks made. These determine the position of the required line more exactly.

In others there is no moveable radius or index. The position of the line is found simply by looking along the arc of the protractor, and making a dot or mark on the paper, at the division corresponding to the given angle.

In common cases of instruments the protractor is generally a semi-circle of brass, the use of which must be manifest from what has been observed above.

A protractor is sometimes in the form of a short ruler, the middle of the edge being the centre, and the edge itself corresponding to the diameter of zero or the commencement of the divisions. In setting off an angle, this edge is laid along a given line, with the central mark on a given point. Then, on the outer edges of the ruler, lines are cut diverging from this mark, which correspond either to degrees, or to points of the compass. At the line which denotes the angle to be set off, a dot is made, and then the straight line is drawn on the paper as before.

(398.) An angle may be set off also by means of a scale of chords, as follows. Let it be required to draw a line from A, making any proposed angle with AB. With a pair of compasses take, from the scale of chords, the distance corresponding to the chord of 60° ; and with that distance, describe from the centre A a circular arc in pencil, cutting AB in a point C. Then take in the compasses the distance corresponding to the chord of the degrees, &c. in the proposed angle, and from the centre C, with this distance as a radius, describe a small circular arc cutting the other circle in a point E. The point of section will be the point to which the required line must be drawn from A.

Mercator's Chart.

(399.) A Mercator's Chart is a representation of part of the surface of the earth made upon a plane surface, constructed as follows (see *App.* 1).

Draw a fine straight line BK (plate 1) along the bottom of a large sheet of paper. At B erect a perpendicular BN to BK, in the following manner: take any point C within the paper as far from B towards the middle of the paper as is convenient; placing the edge of a ruler, or of paper doubled, from B to C, make a mark on the edge at B and C. Then keeping the mark at C stationary, bring the other mark, by turning the edge round C, to a point D on the line BK. Draw a fine straight line DE in pencil through C, and take the distance between the marks on the edge from C to E. Join BE and produce it to the top of the paper; this will be the perpendicular required. With the edge of a ruler or of doubled

paper mark two points at small equal distances from this perpendicular within the paper, and through these points draw a fine line HI, which will be parallel to BN. In a similar manner draw FG within and parallel to BK. From H along the base line take as many equal distances as the chart is to contain degrees of longitude, leaving a sufficient space at the left hand side for a margin: this is done most easily by making two dots on the edge of doubled paper, by trying the distance of these dots on the line, and altering this distance till it appears that, laid as many times on the base line as there are to be degrees of longitude, a proper space only remains to the left. Then placing the edge between the dots on the base line repeatedly, beginning at H, make dots at the same equal distances on it. Divide the space between the dots on the edge of doubled paper into six equal parts (or as many as may be required) by trial, and putting the distance again on the corresponding divisions of the base line, make marks at each intermediate dot. Thus the base line HA will be divided into degrees and subdivisions of degrees. From A erect a perpendicular AM to the base line, in the same manner as the one at B was erected, and taking two small equal distances to the left of it, draw a second straight line KL parallel to it, towards the margin, cutting the interior base line at G. Mark in pencil the degrees of longitude on the base line.

(400.) Write down on a slip of paper the degrees of latitude which the chart is intended to contain, putting the highest degree at the top and the others in order underneath: take out from the tables and write opposite to each the corresponding *meridional parts*, of which take the successive differences from the top to the bottom. Measure with the edge of doubled paper the number of minutes or nautical miles in the lowest difference along the longitudinal scale, that is, along the base line as it has been divided; make two dots on the edge at this distance, and transfer it to the side lines as from F and G to 31. Then in a similar manner transfer the number of minutes in the second difference from the bottom measured on the longitudinal scale from 31 to 32, and so on as far as may be wanted. Mark the points thus got on the side lines with the degrees they represent; at the highest degree draw a line across the paper as NL, and, taking small equal distances above it, draw another line parallel to it as IM. Divide each space for a degree on the side into six equal parts, or as many as may be required, which is done by trial on the edge of doubled paper. Divide the top line similarly to the bottom one.

(401.) It must be observed that all the lines mentioned above are supposed to be drawn in pencil as finely and exactly as possible. The correctness of every step should also be proved by a second measurement. After the whole has been thus tried and found to be correct, the lines must be drawn in ink in the following manner. Take a steel drawing pen, and see that the point is perfect and clean; open the point a little by means of the screw, and fill it with ink; then close it gradually till the pen is found on trial to draw an uniform line, such as is wanted. Indian ink should be used, rubbed on a plate with water, till on trial the mixture is found to have the proper consistency. When the drawing pen is filled with ink, and a ruler laid on any of the pencil lines, the pen should be held in a position something inclined from the perpendicular, and drawn along the edge of the ruler leisurely and steadily; taking care that the edge of the ruler is turned to the light.

(402.) Having thus drawn the lines in ink and written the degrees in ink, the next thing is to draw the line of coast which is to be included in the chart. In the first place we will suppose that the object is only to copy another chart on a different scale. From the chart to be copied find the latitude and longitude of the prominent points of land: lay a ruler across the new chart at the latitude on both sides of any one of these points, and draw a short fine pencil line near the situation of the same point in the new chart, which situation may be estimated nearly; then place the edge of the ruler from top to bottom at the longitude of the point to be determined, and draw another short fine pencil line to cut the former: the intersection will be the point required, at which therefore write in pencil the name. In a similar manner get the places of as many other prominent points of land as may be considered necessary. Take now a piece of paper and sketch in with a pencil between the assumed points the different parts of the coast from the chart to be copied, and then transfer these sketches to the new chart; proceeding thus till the whole coast is delineated.

(403.) To put this outline into ink, take a common pen, and cut its point till a proper line can be drawn with it for the line of coast, which should be quite uniform and distinct, but not too thick. Draw the pen on the pencil lines between the prominent points or headlands; shifting the chart round so as always to draw the pen towards the person, and taking care that the line drawn has the natural waving of a coast, and is of uniform thickness throughout. After this is done, write in ink the names of the points of land, as much as possible on the land side. The line of coast may also, if judged necessary, be shaded in a slight degree always on the land side, and with the utmost neatness and regularity.

The situation of any sounding, anchorage ground, &c. on the coast will be best determined by means of a *station pointer*, the use of which is described in Art. 396. Place the centre of the instrument at the point it is wished to transfer to the new chart, and open the arms so as to pass over three prominent points of the coast; then carry the arms thus set over the corresponding prominent points on the new chart, and the centre will be at the place required. When a station pointer is not at hand, the place of any sounding, anchorage, &c. may be determined in the same manner as that of a headland, from its latitude and longitude.

Lastly, a circle should be described to represent the compass at some spot on the chart; if convenient, on the land. Take the intersection of a meridian and a parallel of latitude for a centre, and with an opening of a few inches describe a circle; mark the points of the circumference cut by the meridian N. and S., that towards the top N., and that towards the bottom S. Mark also the points of the circle cut by the parallel of latitude E. and W. Then divide each of the quadrants into two equal parts, and mark the points of division N.E., S.E., N.W. and S.W.; according to their position; bisect the arcs again for the points N.N.E., E.N.E., &c.; and again for N. b. E., N.E. b. N., &c. In a large chart it may be necessary thus to describe two or three circles on different parts (see plate 1).

Use of Mercator's Chart. (See App. 1.)

(404.) A Mercator's Chart is used in Navigation to find the course and distance from one place to another. Place the edge of a parallel ruler on the two places as marked on the chart, and keeping one part of the

ruler fixed, move the other till the edge passes over the centre of the compass on the chart; the point on which the edge lies will show the course. Thus (plate 1) (1) let O and P be the two places, the course and distance between which are required. On placing one edge of a parallel ruler on O and P, and pushing half the ruler to the compass, the course is found to be N.N.E. The distance from O to P is found nearly by taking OP in a pair of compasses, or on the edge of a piece of paper, and measuring it on the side or latitude scale nearly opposite the two places O and P: the distance is thus found to be 52 nautical miles. The distance thus determined is not however exact, as is evident by completing the figure as on the chart. Through O draw OQ parallel to a meridian by means of a parallel ruler; join OP, and draw PQ parallel to a parallel of latitude by the same means. Then by the construction of the chart, OQ will be the meridional difference of latitude, and PQ the difference of longitude, of O and P. The angle POQ will therefore be the course from O to P, since $OP : OQ :: \text{rad} : \cos POQ$ (see Art. 11, p. 4): but OP will not be the distance, since by Art. 11 $OP : OQ (\text{mer. diff. lat.}) :: \text{rad} : \cos POQ$ or $\cos \text{Course}$; and $\text{Dist.} : \text{Tr. Diff. Lat.} :: \text{rad} : \cos \text{Course}$. To determine the distance exactly from the chart, observe how many minutes there are on the side between the latitude of O and that of P, and taking the same number of minutes in the longitude scale at the bottom or top, by a pair of compasses, or on the edge of doubled paper, set this distance off from O to R, and from R draw a line RS parallel to a parallel of latitude, cutting OP in S; then will OS, measured on the longitudinal scale, be the exact distance. For it is evident that OR is the *tr. diff. lat.*, and since $OS : OR (\text{tr. diff. lat.}) :: \text{rad} : \cos \text{SOR} (\cos \text{Course})$, OS must be the *dist* (see Art. 11).

(405.) When a chart is constructed in the manner described above, with the exception that the degrees of latitude at the side are made of the same length as those of longitude at the bottom or top, such a chart is called a *plane chart*. On this PQ would be the *diff. long.*, and OQ the *tr. diff. lat.*; consequently neither would the angle POQ be the *Course*, nor OP the *dist.* exactly; though for a limited space they might be so nearly enough for the practice of navigation.

Marine Surveying.

(406.) A Marine Survey is the determining, by observations on the ground, of the prominent points of a sea-coast, so that they may be inserted in their true position, as to latitude and longitude, on a Mercator's chart. The intermediate parts of the coast are usually sketched, and the sketches transferred to the corresponding spaces in the chart. The method of determining the soundings, &c. will be apparent from the following description of the different steps of a marine survey in the order in which they may be taken.

(407.) The first thing is to estimate nearly the extent of the survey in latitude and longitude, and to construct a Mercator's chart on a large scale, so as to admit of a few seconds of a degree being set off distinctly on it. This being completed, we may proceed to the ground, and determine the latitude and longitude of a convenient spot or station by astronomical observations. The latitude is best found by repeated meridian altitudes of the sun with a good sextant or a reflecting circle. The method explained in Art. 214, &c. may be practised with very good effect; particularly with such

an instrument as is described generally in Art. 116. The longitude is best determined by means of a chronometer, the error of which on Greenwich mean time has been correctly found at some other place, as also its rate. The sun's altitude is taken both in the morning and the afternoon, when the sun bears nearly east or west, from which mean time at the station is got, and mean time at Greenwich being known from the chronometer, the longitude is easily computed. In these operations the sun's altitude is generally taken by means of an artificial horizon (see Art. 365).

The latitude and longitude of the first station being thus got, its place may be easily determined and marked on the chart.

(408.) The next step is to find the place on the chart of a second station at some distance from the first. This might be done by finding the latitude and longitude of this second station in the same manner as for the former. But as the relative position of the two first stations, upon which depends the correctness of the survey as to the relative position of the other places, might thus be considerably wrong, it is usual to proceed by one or other of the following methods.

First, measure a distance of a mile or two in a straight and horizontal line from the first station to a second assumed station. Also determine the true bearing of the second station from the first, by bringing the sun's image to touch it, at the same instant taking the altitude of sun (see Art. 307). Thus knowing the bearing and the distance, we can calculate (see Art. 11, &c.) the difference of latitude and the difference of longitude; and therefore the latitude and longitude of the second station (see App. 51, &c.)

In using this method there must be level ground between the two first stations, which it is often difficult to find to a sufficient extent. When there is such ground, this is the most exact method of getting correctly the relative position of the stations. In the operation of measuring, a chain is generally used, and sometimes rods laid horizontally. The distance is supposed to be got in nautical miles, and, if not, it must be reduced thereto; and the calculations are to be made with the greatest accuracy to the nearest second.

By referring to the figure in plate 2, two stations, such as have been described, will be seen at A and B.

A *second* method of proceeding is to determine the distance of the two first stations, as A and B, by means of a *micrometrical telescope*; by placing well-defined objects at short equal distances on each side of B, and measuring the angle they subtend at A by means of such a telescope.* The distance is then easily deduced with sufficient correctness for any nautical survey. The bearing is found as in the former method, and the calculations are made in the same manner.

The method by the micrometrical telescope has this advantage, that the distance may be thus measured over uneven ground, or over the water, as from one side of a harbour to another.

* There are two fine steel pins on opposite sides of the object glass, the points of which may be brought to coincide with any two distinct marks subtending a small angle at the eye, by drawing a second object glass out from the first. The angle is marked on the tube drawn out. Or a small angle between two distant distinct objects may be measured by substituting a divided object glass for the single moveable one in the instrument. The great accuracy of these measurements enables a surveyor to deduce a distance therefrom with a sufficient degree of accuracy for any nautical survey, and the instrument is on this account very valuable. An explanation of its use is sold with the instrument.

A *third* method is to determine by a good sextant the latitude of the second station B as well as that of A with as much exactness as possible. This is done by taking meridian altitudes of the sun at both stations on the same day by means of an artificial horizon (see Art. 212), or altitudes by the same means a little before and a little after noon (see Art. 214). The latitude of each station is thus known, and the bearing of one from the other being computed, the difference of longitude is deduced by the proportions in Art. 11, and thence the longitude of the second station.*

A *fourth* method is by observing the altitude of the sun or some other heavenly body at each station, when the bearing of the sun seen from one station is the same as the bearing of the other station. The difference of the corrected or true altitudes will then be the distance in nautical miles of the two stations,† and the bearing of the latter station will be the same as that of the sun.

A *fifth* method is by observing, by means of a watch, the interval in seconds between the flash and report of a gun fired first at one station and then at the other. The mean of two, or rather of several trials, will give the number of seconds very nearly. Allowing 1142 feet for one second, and 6075.5 feet to a nautical mile, the distance may be got with considerable accuracy.‡

These are the principal methods which may be practised in actual surveying; and by one or other of them we may suppose the places of A and B, in plate 2, to be got on the chart.

After having thus determined the two first stations A and B, the other steps of the survey will be best understood by giving an example.

(409.) Let it *first* be required to survey a harbour represented in plate 2, with great accuracy.

For this purpose surveyors have theodolites, sextants, measuring-chains, and every necessary instrument and apparatus. They first sail round the harbour and different inlets, and make an eye sketch. In doing this an extensive and level plane is discovered. At one extremity of this the first point A is fixed, and a line is measured from A exactly three *nautical* miles in length, to a second station fixed upon and called B. A theodolite is put up at A and properly adjusted, with its centre exactly over the point measured from. Another is put up at B, and properly adjusted, with its centre over the point measured to. Standing at A the distance of the sun from B is observed, and at the same instant the altitude of the sun's L. L., from which observations the bearing of B from A is found to be N. 40° 2' E. (see rule, Art. 307). In the meantime the latitude of A is found from observed meridian altitudes, and the longitude by a chronometer, the error of which on Greenwich mean time is supposed to have been very lately ascertained at a place whose longitude is accurately known. The lati-

* In doing this care must be taken to compare the instruments used, by taking altitudes with them at the same place.

† This may be applicable in getting the distance of a boat from the ship or from another boat, when the sun is not too high. The point of contact of the sun on the horizon must be seen over one of the boats. The instruments used should be compared by taking several altitudes simultaneously at the same station from the two boats, or from the boat and ship; thus any error of instrument and dip may be removed.

‡ When Fahrenheit's thermometer stands at 32, velocity of sound is 1090 feet per second, in dry air. When it stands higher, add 1 foot for every degree above 32.

tude at A is $45^{\circ} 10' 30''$ N., and the longitude $30^{\circ} 2'$ W. Having proceeded so far, assistants are sent round the coast or beach, and poles or flagstaffs are fixed at a distance of about half a mile from each other.

Having made these preparations for the farther prosecution of the survey, an observer at A takes the angle, which each flagstaff makes with B, and also the angle which each principal object in the neighbourhood makes with B. An observer at B then takes the angle, which each of these flagstaffs or objects makes with A; taking care at both principal stations A and B not to observe any angles less than about 10° . The soundings are next taken. A boat is rowed across the harbour, and at short distances the depth of water is measured; at the same instant a flag is hoisted, and the angles it makes at A with B, and at B with A, are measured; taking care as before that the boat is not brought into such a situation that the angle at A or B is less than about 10° . In the figure all station flagstaffs from *a* to *l* are determined from A and B, and all the intermediate soundings, together with the conspicuous objects C, D, and E. Afterwards the theodolites are taken to *d* and *f*, and all the station flagstaffs along the opposite beach from *w* to *dd* are thence determined, together with the soundings between those points which had not been found from A and B, and the conspicuous objects F, G, H, I, and K. The instruments are then moved to *g* and *i*, and the places of the station flagstaffs *m*, *n*, *o*, are thence fixed, with the intermediate soundings. In order to determine the place of *h*, a theodolite is carried thither, and the angles are taken between F and E, and E and D. In going round the beach the form of the coast between the different flagstaffs is sketched, and it is at the same time noted down whether the shore is rocky or sandy, steep or shelving. In sounding, not only the depth is put down, but also the nature of the bottom is noted at the corresponding spot on the chart.

(410.) We have in the above plan of proceedings supposed the figure to be the ground to be surveyed. It must now be considered as the chart containing the survey, the method of constructing which may be described in a few words.

Consider within what limits of latitude and longitude the survey is contained, as near as can be estimated roughly. Take a convenient distance, as one inch, two inches, &c. for a mile of longitude. Draw a fine line on the bottom of the paper, upon which take the proper number of miles, and proceed in getting in the side lines for setting off the latitude as directed in Art. 399, &c. Marking at the bottom the lowest latitude assumed, find meridional parts for the next mile, and taking them on the longitudinal scale, set them up the side line. Proceed in a similar way with the second line of latitude and so on to the top of the chart.

Draw the lines at the top of the chart, and then as many intermediate meridians and parallels of latitude as may appear necessary. Subdivide the miles of latitude, and, before anything further is done, put the lines already drawn into ink, and write the proper latitude and longitude at the principal divisions. The latitude and longitude of A are $45^{\circ} 10' 30''$ N. and $32^{\circ} 2'$ W. From these and the bearing and distance of B, namely, N. $40^{\circ} 2'$ E. 3 miles, the latitude and longitude of B are computed to be $45^{\circ} 12' 47''.8$ N. and $31^{\circ} 59' 15''.7$ W. From these latitudes and longitudes, the places of A and B are easily determined on the chart. Put the centre of a protractor on A, and zero on the line AB or AB produced; make a dot with the steel point, properly set, at the different angles measured at A, or at as many of

them as can be included without confusion. Draw fine straight lines in pencil through these points from A, and mark each with the distinguishing letter of the object to be found. In a similar manner set off the corresponding angles observed at B, and draw straight lines through the spots thus got, marking them also with the name of the object observed. The points where the lines, drawn from A and B, and marked with the same letter, meet, will be the points required. At these put the distinguishing letters, and rub out the pencil lines. Draw other lines from A and B, and thus go on, till all the station flagstaffs, conspicuous objects, and points of sounding observed therefrom, are fixed on the chart. Each point of sounding must be marked with a figure denoting the depth of water at low water after an average spring tide (see Art. 315).*

(411.) Having determined all the points seen from A and B, put the protractor now first at *d* and then at *f*, and set off the angles observed there. Thus find the points seen from *d* and *f*. Proceed afterwards with the protractor to *g* and *i*, and determine the points seen thence. The situation of *h* is found by means of a station pointer. Set one ruler to the angle *FhE*, and the other to the sum of *FhE* and *EhD*. Put the edge of the fixed ruler on F, and shift the centre round till the edges of the moveable rulers pass over E and D. Through the central hole make a mark with the steel pen, and this will be the place of *h* on the chart.

Now sketch in the coast in pencil, and represent on it the parts that are rocky and abrupt, or sandy and flat. Shade it finely towards the land. Where a sand bank in the harbour is dry at low water, put dots; where rocks are dry at low water, put a little shading and small crosses. Sketch the conspicuous objects laid down, as D, E, &c. Denote the time of change tide, and the heights of spring tide and neap tide by Roman figures, in as many parts of the harbour as they have been observed and appear necessary. Describe a compass, if possible, on a part of the land, as there it will not interfere with the figures put for the depth of water. Finally, let all that has been thus done be put into ink with as much neatness and distinctness as possible; and the chart will be complete.

(412.) We have supposed in the above example of a marine survey, that the persons employed have an unlimited command of instruments and other means. But it will frequently happen that a single observer may be called upon to go through all the necessary operations himself with very few instruments. In such a case he may, if he choose, determine the conspicuous objects C, D, E, &c. with the flagstaffs *a*, *b*, *c*, &c. first by taking angles at A, and then B. Or, if he prefer this mode of proceeding, he may thus determine the places of the conspicuous objects C, D, E, &c.; and then those of the coast stations by taking at each the angles which one of the conspicuous objects makes with two others, using a station pointer to find the coast stations. Or he may possibly use both methods.

In fixing the points of sounding, he cannot proceed in the manner described in the above example; for in doing so he would be under the necessity of going from A to B at every sounding, for the purpose of taking the angles which the boat at that instant made with each of these principal points. Instead of this he must take two angles, at each place of sound-

* The rise and fall of the tide should be determined at some point at short intervals, while the sounding is going on, and thus the soundings taken at any time may be reduced to low water.

ing, between three of the principal objects, and by setting the station pointer to the angles he easily finds the place of sounding on the chart.*

The three objects chosen in taking these two angles should be such, that each of the angles may be as nearly as possible 120° ; the instrument used in taking the angles is a sextant. The arms of the station pointer set to the angles are put on the chart over the spots corresponding to the three objects, and the centre of it at the place of sounding, which should be marked accordingly.

(413.) The following may be considered as a *second* example of marine surveying. It is required to survey the coast of the island in plate 3, without landing, and in as short a time as possible. For this purpose suppose three boats are anchored on the coast at A, B, and C, about 5 or 6 miles asunder, two of them, as A and B, being nearly north and south, so that when the sun is nearly east or west, it may be nearly abreast of AB. The latitude and longitude of A are determined, the former by meridian altitudes of the sun or by the method in Art. 214; the latter by means of a chronometer. The latitude of B is determined by similar methods to those used for A, and if practicable with the same instrument; and the true bearing of B from A by taking the sun's distance from B at the same instant the altitude of its L. L., when the sun is nearly abreast of the line AB (see Art. 307). Knowing the two latitudes and the bearing or course, the difference of longitude between A and B may be easily computed by the proportions in Art. 11, and thence the longitude of B. Thus therefore we know the latitude and longitude of both A and B, and can fix them on the chart.†

(414.) Let A and B therefore be now considered as known points on the chart. The next step is to determine the place of the boat at C, which is done by observing at A the angle between B and C, and at B the angle between A and C; these two angles being set off at the points A and B on the chart, and lines being drawn making those angles with AB, the point of their intersection will be at C. Thus the places of the three boats on the chart are found. When the boats A and C, or B and C, are more conveniently placed for taking the sun's distance and altitude, and computing the bearing of one from the other (see Art. 307), the observer may proceed thus: find, as above, the latitude and longitude of A and C, or B and C, and then, by means of angles taken at these two, the position of the third boat.

Let the boat C be now supposed to sail on the coast, and a person in it, to sound at short intervals, and at the same instant to hoist a flag, while the observers at A and B take angles, the former between B and the flag, the latter between A and the flag. These two angles being set off at A and B on the chart, the place thereon for the soundings is known, and thus a sufficient number of soundings are taken abreast

* It is usual in common cases to sail or row uniformly from one known point to another, sounding at equal intervals, and to divide the corresponding line on the chart into as many equal parts as intervals; thus putting in the corresponding soundings.

† If one of the boats be stationed so as to bear nearly east or west from another, it is possible that the *fourth* method (Art. 408) of determining its bearing and distance may be applied. If the *fifth* method be applied, the boats should be stationed so that, as points of reference, the ground and soundings may be most easily and correctly laid down by angles taken either from them or from the moveable boat or boats.

of A and B. At the same time the prominent points of land are determined in a similar manner by taking angles at A and B, and the line of coast is sketched in.

(415.) When the the angles taken from A and B become too acute, that is, less than 10° , let the sounding boat be anchored up the coast as at *o*, a point previously fixed on the chart from A and B, and let the boat A be shifted from A to some point outside as at D, so that B and D may be abreast of *o* and of a second portion of the coast. To find the place of D on the chart, take at B the angle between D and *o*, and at D take the angle between B and *o*, subtract the sum of these two angles from 180° , and the remainder will be the angle at *o*, between B and D. On the chart set off the angle at B, and at *o* the angle at *o*; the lines drawn will meet at the place of D. Then proceed as before, moving the sounding boat from *o*, taking new soundings, and fixing their places by angles taken at B and D, and also the prominent points, &c., of the coast as before. When this part of the survey is finished, the boat B must be moved farther up the coast, and a similar process to the one just explained must be repeated, till the whole coast is surveyed and entered on the chart.

It may be observed that the soundings should be taken as much as possible at low water, or if this be not practicable, an allowance should be made by noting the rise and fall of the water at some near point.

In continuing the survey round the island, the latitude should be found from a meridian altitude of the sun whenever it is practicable, and the survey verified or corrected by this latitude.

(416.) Sometimes in such a survey, in order to have the use of more boats in sounding, &c., buoys with flags are placed for known points of reference. Thus should there be only one boat, buoys may be fixed both at A and B, the angle taken at C between A and B, and then a buoy being left at C, the boat may be brought to A and the angle observed there between B and C. Or this method may be adopted: fix these buoys, one on each side of the part to be surveyed, as at A, B, and *d*. Fix the places of these buoys on the chart as A, B, and C were fixed (Art. 413), and then in sounding take two angles between these buoys, which with the aid of a station pointer will determine the place of the sounding boat on the chart. Any prominent point of the coast is determined by taking the angles between it and one of the buoys at two places of the sounding boat which may be considered as known. This part of the coast being surveyed, two of the buoys, as A and C, are shifted farther up the coast, their new places being fixed on the chart by taking angles from the last known station of the sounding boat, and from the buoy at B which has not been moved. The surveyor may thus extend his survey round the island.

(417.) The *third* example in marine surveying is merely to fix places on the chart of any prominent points of land or other objects in sailing past them.

Make correct observations in the ship to determine its latitude, as often as possible. Determine also the longitude by chronometer, whose error on Greenwich is supposed known at the commencement of the survey with considerable exactness; and keep the log account correctly, so that upon the whole the ship's place on a chart may be marked off at the end of every hour. When a point of land is seen, take its bearing with azimuth com-

pass, and then again afterwards, supposing the bearing of the point to have changed several points; taking care to note the hour and minute of each observation. Do this for the different prominent points of land as they are passed. Sketch the coast, and take soundings in the ship. Having constructed a chart to the limits of the run along the coast, mark off the ship's place at the beginning of each hour, and the track of the ship as nearly as possible in the intervals. From the places, whence two bearings of the same points of land were taken, draw straight lines in the direction of the true bearings; and they will meet in the spot on the chart corresponding to the point of land observed. Thus find the place on the chart of every object or headland, of which two bearings have been taken. Sketch in the coast, and add the soundings taken in the ship's track, by dividing the hour stations into equal parts.

Or (which would be far more accurate) the true bearings of the prominent points of land and other objects may be determined by taking the distance of the sun, moon, or a star from them and the altitude of the heavenly body at the same time; from which observations, properly taken, the bearing may be found with much greater accuracy than by means of the azimuth compass. The true bearing of any prominent object being thus got at two known positions of the ship, the place of the object is fixed on the chart as just explained (see Art. 307, and *App.* 50, &c.)

EXAMPLES.

(418.) **NOTE.**—The following easy examples to the foregoing rules may perhaps be of some use to the young student in Navigation and Nautical Astronomy. They will be found arranged in sets, under distinct letters, A, B, C, &c., and the elements necessary for working them will be found subjoining each set. The answers considered as correct are added to the elements for each example.

In using the elements put down, the young student may at the same time turn to the proper page and column in any Nautical Almanac, whereby he will acquire a facility in taking the necessary elements from the Nautical Almanac, when required for observations made at sea.

It must be recollected that the R. A. of the *mean sun* is found in the Nautical Almanac, in page 11 of each month, in the column headed *Sidereal Time* (see note, p. 79): and also, that the *equation of time* is marked *Add* or *Subt.*; as directed in the note, p. 79.

A.

1. Required the course and distance from A to B, lat. A $63^{\circ} 53'$ S., long. A $15^{\circ} 26'$ E.; lat. B $59^{\circ} 10'$ S., long. B $22^{\circ} 10'$ E.

2. The latitude of a ship is $50^{\circ} 4'$ N. and long. $16^{\circ} 21'$ W.; required the course and distance to the Land's End.

3. A point of land bore from me E. b. N. $\frac{3}{4}$ N., and a current run in the intermediate space due E. $4\frac{1}{2}$ miles an hour; how must I steer a boat to fetch the point of land, supposing I can pull in still water 7 miles an hour?

4. Feb. 1, 1836, at noon, a point of land in latitude $49^{\circ} 56'$ S., and long. $7^{\circ} 12'$ E. bore by compass W. b. S. $\frac{1}{2}$ S. distant 19 miles (variation $1\frac{3}{4}$ E.); afterwards sailed as by the following log account: required the latitude and longitude in on Feb. 2, at noon.

H.	K.	$\frac{1}{10}$ ths	Course.	Wind.	Lee-way.	
1	4	2	S.S.W. $\frac{1}{2}$ W.	West.	$2\frac{3}{4}$	P.M.
2	4	5				
3	3	7				
4	3	6				
5	4	0				
6	3	7	S.S.E.	East.	$2\frac{1}{4}$	Variation $1\frac{3}{4}$ E.
7	4	3				
8	4	5				
9	4	7	W. $\frac{1}{2}$ N.	North.	0	
10	8	4				
11	9	2				
12	10	3				
						Remarks in H. M. S. February 2, 1836.
1	10	5	A.M.
2	10	6				
3	10	4				
4	11	5				
5	4	6				
6	3	7				
7	3	2				
8	3	4				
9	3	6				
10	4	0				
11	4	5				
12	4	6				

5. At what time (mean) will α Tauri (Aldebaran) pass the meridian of St. Petersburg, on Feb. 8, 1836, and how far N. or S. of zenith?

6. Feb. 2, 1836, in longitude $76^{\circ} 25'$ E., the observed meridian altitude of the sun's L. L. was $30^{\circ} 10' 40''$ (zenith N. of the sun); the index correction was $-2' 20''$, and the height of the eye above the sea was 13 feet: required the latitude.

7. Feb. 21, 1836, at $3^h 50^m$ P.M. (mean time nearly) in longitude $104^{\circ} 13'$ W., the observed meridian altitude of the moon's L. L. was $40^{\circ} 25' 32''$ (zenith N. of the moon); the index correction was $+4' 10''$; and the height of the eye above the sea was 20 feet: required the latitude.

8. Feb. 2, 1836, the observed meridian altitude of the star α Tauri (Aldebaran) was $29^{\circ} 52' 10''$ (zenith S. of the star); the index correction was $+5' 20''$, and the height of the eye above the sea was 15 feet: required the latitude.

9. Feb. 2, 1836, the observed meridian altitude of the star α^1 Crucis, under the S. Pole, was $11^{\circ} 25' 10''$; the index correction was $-5' 50''$, and the height of the eye above the sea was 14 feet: required the latitude.

10. Feb. 2, 1836, at $1^h 20^m$ A.M. (mean time nearly), in longitude $178^{\circ} 22'$ W., the observed altitude of α Urs. Min. (Polaris) was $54^{\circ} 27' 10''$; the index correction was $-2' 45''$, and the height of the eye above the sea was 13 feet: required the latitude.

11. Oct. 29, 1836, observed the following double altitude of the sun.

Mean T. nearly	Chronometer.	Obs. Alt. Sun's L. L.	Tr. Bearing.
11 ^h 15 ^m A.M.	11 ^h 21 ^m 15 ^s	25° 26' 20"	S. $\frac{3}{4}$ E.
11 30 A.M.	11 37 55	25 55 0	S. $\frac{1}{4}$ E.

The run of the ship in the interval was S.W. 1 mile; the index correction was +3' 50"; and the height of the eye above the sea was 20 feet: required the latitude at the second observatoin, the latitude by account being 52° N. and the longitude 47° 10' W.

12. Feb. 8, 1836, at 4^h 30^m P.M., in latitude 36° 20' S., and longitude by account 75° W., a chrouometer showed 10^h 48^m 2^s, and the observed altitude of the sun's L. L. was 25° 25' 25"; the index correction was - 1' 50" and the height of the eye above the sea was 14 feet: required the true longitude.

The chronometer, at Gr. noon on Feb. 8, 1836, was *fast* on Greenwich mean time 1^h 2^m 21^s, and its daily rate was 8^s.6 *gaining*.

13. Feb. 2, 1836, at 11^h 58^m P.M. in latitude 22° 20' N., and longitude by account 41° 50' E., the following lunar observation was taken.

Obs. Alt. α Tauri (Aldebaran) West.	Obs. Alt. Moon's L. L.	Obs. Dist. F. L.
21° 58' 30"	89° 10' 40"	67° 39' 30"
2 50+	1 10 -	3 20 +

The height of the eye above the sea was 14 feet: required the true longitude.

14. Feb. 3, 1836, at 7^h 10^m P.M., in latitude 49° 12' S., and longitude 115° 28' E., the sun set by compass W. 10° 42' S.: required the variation.

15. Feb. 3, 1836, at 5^h 0^m A.M., in latitude 51° 10' S., and longitude 125° 10' W., the compass bearing of the sun was E. 2° 10' N.: and the observed altitude of the sun's L. L. was 5° 20' 10"; the index correction was +1' 50", and the height of the eye above the sea was 14 feet: required the variation.

16. Required the mean time of high water on Feb. 20, 1836, A.M. and P.M. Change Tide 4^h 50^m P.M. App. T., long. 50° W.

Elements for A, from Nautical Almanac 1836, with Answers.

1. N. 34° 13' E. 342'.2 miles.
2. East 410.2 miles.
3. N.E.b.E.
4. Corrected courses E $\frac{1}{4}$ S. 19' Dep. Course; S. b. W $\frac{1}{2}$ W. 20'; S. S. W. 17'.2; N.W. b. W. $\frac{3}{4}$ W. 70'.9; N.W. b. W. $\frac{3}{4}$ W. 31'.6; N.E. $\frac{1}{4}$ E. 24'. Latitude in 49° 32' S., longitude in 5° 26' E.
5. R. A. mean sun, Feb. 8, at Gr. mean noon, 21^h 10^m 32^s.21. R. A. α Tauri 4^h 26^m 30^s.9, decl. 16° 10' 28" N. At 7^h 15^m, S. of zenith 43° 45' 30".
6. Sun's decl. on Feb. 1, at Gr. mean noon, 17° 17' 8" S.; on Feb. 2. 17° 0' 5" S.; sun's semid. 16' 15". Latitude 42° 36' 58" N.
7. Moon's decl. on Feb. 21, at 10^h mean time, 11° 18' 9" N., at 11^h 11° 30' 50" N.; moon's semid. on Feb. 21, at Gr. mean noon, 15' 6".3, on Feb. 21, at Gr. mean midn., 15' 1".5; corresponding hor. par. 55' 26" and 55' 8". Latitude 60° 6' 53" N.
8. Decl. 16° 10' 28" N. Latitude 43° 57' 32" S.
9. Decl. 62° 11' 5" S. Latitude 38° 59' 49" S.
10. R. A. mean sun on Feb. 2, at Gr. mean noon, 20^h 46^m 52^s.9. Latitude 55° 30' N.
11. Sun's decl. on Oct. 29, at Gr. mean noon, 13° 34' 33" S., on Oct. 30, 13° 54' 18" S., sun's semid. 16' 8". Latitude 49° 56' N.
12. Sun's decl. on Feb. 8, at Gr. mean noon, 15° 11' 51" S.; on Feb. 9, 14° 52' 52" S.; corresponding equ. time 14^m 28^s.5 A., and 14^m 30^s.8 A. Hour angle W. 4^h 36^m 22^s. Longitude 73° 41' 30" W.
13. R. A. mean sun on Feb. 2, at Gr. mean noon, 20^h 46^m 52^s.9; decl. of α Tauri 16^h 10^m 28^s N.; R. A. α Tauri 4^h 26^m 31^s. Moon's hor. semid. on Feb. 2, at Gr. mean noon, 15' 7".3, at Gr. mean midn., 15' 11".2: cor. hor. par. 55' 29".6, and 55' 43".8. True dist. 67° 30' 20"; dist. from Naut. Alm. at IX, 67° 23' 32"; at XI, 68° 57' 39". Hour angle 4^h 49^m 54^s. Longitude 48° 46' 7" E.
14. Sun's decl. on Feb. 2, at Gr. noon, 17° 0' 5" S., on Feb. 3, 16° 42' 45" S. Tr. bearing W. 26° 7' 30" S. Variation 15° 25' 30" W.
15. Sun's decl. on Feb. 3, at Gr. mean noon, 16° 42' 45" S on Feb. 4, 16° 25' 8" S. semid. 16' 14" W. Tr. bearing S. 69° 59' 15" E. Variation 22° 10' 45" E.
16. Moon's Gr. mer. passage, Feb. 20, 3^h 12^m.8; Feb. 19, 2^h 29^m.4. Eq. T. 14^m sub. to M. T., moon's semid. 15' 17". High Water 6^h 58^m A.M. and 7^h 20^m P.M.

B.

1. Required the course and distance from A to B. Lat. A $56^{\circ} 10' N.$, long. A $1^{\circ} 20' W.$, lat. B $50^{\circ} 15' N.$, long. B $4^{\circ} 30' W.$

2. Required the course and distance from A to B. Lat. A $65^{\circ} 25' S.$, long. A $120^{\circ} 13' W.$, lat. B $65^{\circ} 25' S.$, long. B $115^{\circ} 40' W.$

3. A point of land bore from me North, and a current run in the intermediate space E.N.E., $3\frac{1}{4}$ miles an hour; how must I steer a boat to fetch the point, supposing I can pull in still water 6 miles an hour?

4. Oct. 14, 1835, at noon a point of land in latitude $50^{\circ} 20' S.$, and longitude $20^{\circ} 10' E.$, bore by compass E. $\frac{1}{2}$ N. distant 15 miles (variation $2\frac{1}{4} W.$); afterwards sailed as by the following log account: required the latitude and longitude in on Oct. 15, at noon.

H.	K.	$\frac{1}{10}$ ths	Course.	Wind.	Lee-way.	
1	3	5	S.S.W. $\frac{1}{4} W.$	West.	$2\frac{3}{4}$	P. M. Variation $2\frac{1}{4} W.$
2	3	6				
3	4	0				
4	4	2	S.S.W.	W. $\frac{1}{2} N.$	$1\frac{3}{4}$	
5	4	3				
6	4	4	..	..	..
7	4	1				
8	3	7				
9	3	6				
10	4	2	N.N.W. $\frac{1}{2} W.$	W. $\frac{1}{2} S.$	2	
11	4	3				
12	5	0				
						Remarks in H. M. S. Oct. 15, 1835.
1	4	2	A. M. A current set the ship E.S.E. 2 miles an hour the whole day.
2	4	3	E. b. S. $\frac{3}{4} S.$	S. $\frac{1}{2} E.$	$2\frac{1}{4}$	
3	4	2				
4	3	6				
5	3	4	S.W. b. W.	Do.	$2\frac{1}{2}$	
6	3	5	..	..	..
7	4	3				
8	4	7				
9	4	6				
10	9	2	S. $\frac{1}{2} E.$	West.	0	
11	9	4				
12	9	6				

5. What bright fixed stars will pass the meridian of Greenwich between $11^h 10^m$ P. M. on Feb. 22, 1836, and $1^h 40^m$ A. M. on Feb. 23, 1836?

6. Feb. 11, 1836, in longitude $32^{\circ} 20' E.$, the observed meridian altitude of the sun's L. L. was $30^{\circ} 25' 10''$, zenith N. of the sun; the index correction was $-3' 15''$, and the height of the eye above the sea was 12 feet: required the latitude.

7. Feb. 11, 1836, at $7^h 0^m$ A. M., in longitude $25^{\circ} 16' W.$, the observed meridian altitude of the moon's L. L. was $28^{\circ} 10' 40''$ (zenith N. of moon); the index correction was $+4' 15''$, and the height of the eye above the sea was 19 feet: required the latitude.

8. Feb. 10, 1836, the observed meridian altitude of α Arietis was $50^{\circ} 25' 10''$ (zenith S. of the star); the index correction was $+3' 10''$, and the height of the eye above the sea was 12 feet: required the latitude.

9. Nov. 15, 1836, the observed meridian altitude of α Argus (Canopus), under the South Pole, was $40^{\circ} 20' 50''$; the index correction was $+4' 24''$, and the height of the eye above the sea was 20 feet: required the latitude.

10. Feb. 8, 1836, at $10^h 40^m$ P. M., in longitude $178^{\circ} 40' E.$, the observed altitude of α Urs. Min. (Polaris) was $68^{\circ} 40' 10''$; the index correction was $-4' 10''$, and the height of the eye was 11 feet: required the latitude.

11. June 2, 1836, the following double altitude of the sun was observed.

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L. L.	Tr. Bearing.
9 ^h 50 ^m A.M.	9 ^h 52 ^m 28 ^s	51° 17' 45"	S.E. $\frac{3}{4}$ S.
11 15 A.M.	11 14 29	59 32 15	S. b. E.

The run of the ship in the interval was W.S.W. $\frac{3}{4}$ W. 10 miles; the index correction was $-40''$; and the height of the eye above the sea was 12 feet: required the true latitude, the latitude by account being 52° N., and the longitude 21° W.

12. June 5, 1836, at 9^h 15^m A. M. mean time nearly, in latitude $48^\circ 32'$ N., and longitude $14^\circ 5'$ W., a chronometer showed 9^h 51^m 5^s, and the observed altitude of the sun's L. L. was $47^\circ 10' 15''$; the index correction was $+1' 20''$, and the height of the eye above the sea was 15 feet: required the true longitude.

May 27, 1836, at Gr. mean noon, the chronometer was *slow* on Greenwich mean time $12^m 50^s$, and its daily rate was $4^s.5$ *losing*.

13. April 2, 1836, at 0^h 15^m A. M., in latitude $30^\circ 10'$ N., and longitude by account $46^\circ 20'$ E., the following lunar observation was taken.

Obs. Alt. α Leonis West of Mer.	Obs. Alt. Moon's L. L.	Obs. Dist. N. L.
45° 25' 20"	56° 42' 10"	44° 2' 10"
+ 1 30	- 1 20	- 0 50

The height of the eye above the sea was 18 feet: required the true longitude.

14. Feb. 10, 1836, at 5^h 2^m P. M. mean time nearly, in lat. $50^\circ 48'$ N., and longitude $142^\circ 25'$ E., the sun set by compass W. $5^\circ 10'$ N.: required the variation.

15. Feb. 10, 1836, at 8^h 2^m A. M., in latitude $50^\circ 48'$ N., and longitude $91^\circ 10'$ W., the compass bearing of the sun was S. $70^\circ 10'$ E.; and the observed altitude of its L. L. was $7^\circ 10' 40''$; the index correction was $-1' 10''$, and the height of the eye above the sea was 15 feet: required the variation.

16. Required the time of high water at A on April 10, 1836, A. M. and P. M. Change Tide at 4^h 50^m P. M. app. time. Long. A $89^\circ 10'$ W.

Elements for B, from Nautical Almanac 1836, with Answers.

1. S. $17^\circ 44' 15''$ W. $372'.7$ miles.

2. E. $113'.5$ miles.

3. N.N.W. $\frac{1}{2}$ W.

4. Corrected courses S.W. b. W. $\frac{1}{4}$ W. $15'$ Dep. Course; S.S.E. $\frac{3}{4}$ E. $11'.1$; S.S.E. $24'.3$; N.N.W. $\frac{3}{4}$ W. $17'.7$; N.E. b. E. $\frac{1}{4}$ E. $12'.1$; S.W. b. W. $\frac{1}{4}$ W. $20'.5$; S.S.E. $\frac{3}{4}$ E. $28'.2$; E. $\frac{1}{4}$ N. $48'$. Latitude in $51^\circ 10' 30''$ S.; longitude in $21^\circ 27'$ E.

5. R. A. of mean sun Feb. 22, at Gr. mean noon, $22^h 5^m 43^s.97$; R. A. α Hydræ $9^h 19^m 32^s.6$; R. A. γ Urs. Maj. $11^h 45^m 12^s.3$. From α Hydræ to γ Urs. Maj. inclusive.

6. Sun's decl. on Feb. 10, at Gr. mean noon, $14^\circ 33' 39''$ S.; on Feb. 11, $14^\circ 14' 10''$ S. semid. $16' 13''$. Latitude $45^\circ 11' 4''$ N.

7. Moon's decl. on Feb. 10, at 20^h Gr. mean time, $22^\circ 48' 32''$ S., at 21^h $22^\circ 57' 11''$ S.; moon's hor. semid. on Feb. 10, at Gr. midn., $16' 10''.2$, Feb. 11, at noon $16' 12''.6$, corresponding hor. par. $59' 20''$ and $59' 29''$. Latitude $37^\circ 48' 5'$ N.

8. Decl. α Arietis $22^\circ 41' 3''$ N. Latitude $16^\circ 54' 50''$ S.

9. Decl. of α Argus (Canopus) $52^\circ 36' 13''$ S. Latitude $77^\circ 43' 29''$ S.

10. R. A. of mean sun on Feb. 7, at Gr. mean noon, $21^h 6^m 35^s.66$. Latitude $68^\circ 56'$ N.

11. Sun's decl. on June 1, at Gr. mean noon, $22^\circ 6' 22''$ N., on June 2, $22^\circ 14' 14''$ N.; semid. $15' 47''$, Latitude $50^\circ 47' 45''$.

12. Sun's decl. on June 4, at Gr. mean noon, $22^\circ 28' 48''$ N.; on June 5, $22^\circ 35' 30''$ N.; cor. Eq. T. $2^m 3^s.3$ S., and $1^m 53^s.1$ S.; semid. $15' 47''$. Longitude $14^\circ 29' 30''$ W.

13. R. A. mean sun on April 1, at Gr. mean noon, $15^h 58^m 7^s.7$, at Gr. midn. $16^h 3^m 5^s.5$; cor. hor. par. $58' 38''.1$, and $58' 53''.9$. True dist. $44^\circ 9' 4''$; dist. from Naut. Alm. at IX $44^\circ 3' 39''$ at midn. $45^\circ 48' 46''$. Hour angle $2^h 58^m 21^s$ W. Longitude $46^\circ 56'$ E.

14. Sun's decl. on Feb. 9, at Gr. noon, $14^\circ 52' 52''$ S., on Feb. 10, $14^\circ 33' 39''$ S. True bearing W. $23^\circ 44' 45''$ S. Variation $28^\circ 42' 15''$ W.

15. Sun's decl. on Feb. 10, at Gr. mean noon, $14^\circ 33' 39''$ S.; on Feb. 11, $14^\circ 14' 10''$ S.; semid. $16' 13''$. Tr. bearing N. $123^\circ 47' 15''$ E. Variation $13^\circ 57'$ E.

16. Moon's Gr. mer. passage on April 10, $20^h 42^m$. M. T., April 9, $19^h 49^m$; semid, $15' 51''$. Eq. T. 1^m S. from M. T. High Water $0^h 31^m$ A. M., and $0^h 57^m$ P. M.

C.

1. Required the course and distance from A to B. Lat. A $57^{\circ} 36' N.$, long. A $2^{\circ} 10' E.$; lat. B $64^{\circ} 15' N.$, long. B. $5^{\circ} 16' W.$

2. Find the course and distance from X to Y. Lat. X $49^{\circ} 15' N.$, long. X $20^{\circ} 15' W.$; lat. Y $49^{\circ} 15' N.$, long. Y $10^{\circ} 2' E.$

3. On Dec. 1, 1836, a point of land bore from me N.N.E., and a current run in the intermediate space, N.b.W. 3 miles an hour; how must I steer, supposing I can pull in still water 5 miles an hour?

4. On Dec. 1, 1836, in longitude $18^{\circ} 28' E.$, and latitude $34^{\circ} 28' S.$, a point of land bore N. W. 10 miles (variation of the compass $2\frac{1}{4} W.$); afterwards sailed as by following log account; required the latitude and longitude in on Dec. 2, 1836.

H.	K.	$\frac{1}{10}th.$	Course.	Wind.	Lee-way.	
1	5	4	N. b. E. $\frac{1}{2} E.$	N.W. $\frac{1}{2} W.$	$2\frac{1}{4}$	A. M.
2	5	2				
3	5	8				
4	6	1				
5	6	5	S.S.W.	N.W.	$\frac{1}{4}$	Variation $2\frac{1}{4} W.$
6	7	3				
7	7	0				
8	7	2				
9	6	8	N.W. b. W.	S.E.	0	
10	6	5				
11	6	1				
12	5	8	S. b. W. $\frac{3}{4} W.$	S.E. $\frac{1}{4} E.$	$2\frac{1}{4}$	
						Remarks in H. M. S., Dec. 2, 1836.
1	6	0	..	..	..	A. M.
2	6	5				
3	6	8				
4	6	4	N.N.E.	N.W.	2	
5	6	0				
6	6	5	..	..	..	A current set the ship the last 5 hours
7	6	8				N.W. 2 miles an hour.
8	7	2	N.W.	East.	0	
9	7	6				
10	7	9				
11	8	1				
12	8	5				

5. At what time was γ Draconis on the meridian of Lisbon on May 1, 1836; and how far N. or S. of the zenith?

6. Oct. 20, 1836, in longitude $150^{\circ} 25' E.$ the observed meridian altitude of the sun's L. L. was $50^{\circ} 25' 10''$ (zenith S. of the sun); the index correction was $-5' 10''$; and the height of the eye above the sea was 19 feet: required the latitude.

7. Oct. 12, 1836, at $4^h 27^m$ A.M. mean time nearly, in longitude $50^{\circ} 40' E.$, the observed meridian altitude of the moon's L. L. was $39^{\circ} 52' 40''$ (zenith N. of the moon); the index correction was $-10' 40''$, and the height of the eye above the sea was 20 feet: required the latitude.

8. July 5, 1836, the observed meridian altitude of α Arietis was $40^{\circ} 20' 25''$ (zenith N. of the star); the index correction was $-4' 25''$, and the height of the eye above the sea was 19 feet: required the latitude.

9. Jan. 15, 1836, the observed meridian altitude of α Urs. Maj., under the North Pole, was $13^{\circ} 42' 20''$; the index correction was $-4' 10''$, and the height of the eye above the sea was 20 feet: required the latitude.

10. July 7, 1836, at $5^h 20^m$ A.M. mean time nearly, in longitude $100^{\circ} 20' E.$, the observed altitude of α Urs. Min. (Polaris) was $70^{\circ} 20' 10''$; the index correction was $+1' 50''$, and the height of the eye above the sea was 12 feet: required the latitude.

11. On April 10, 1836, the following double altitude of the sun was observed:—

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L. L.	Tr. Bearing.
11 ^h 0 ^m A. M.	6 ^h 5 ^m 10 ^s	40° 10' 15"	S. S. E.
2 0 P. M.	9 6 10	35 15 40	S. W. b. S.

The run of the ship in the interval was N. N. E. 29 miles; the index correction was + 2' 10"; and the height of the eye above the sea was 18 feet: required the true latitude, the latitude by account being 50° 15' N., and the longitude 110° 15' W.

12. May 10, 1836, at 3^h 10^m P. M. mean time nearly, in latitude 48° 12' N., and longitude by account 45° 10' E., when a chronometer showed 0^h 10^m 42^s, the observed altitude of the sun's L. L. was 37° 20' 10"; the index correction was + 3' 10", and the height of the eye above the sea was 18 feet: required the true longitude.

On May 1, at Gr. mean noon the chronometer was *fast* on Gr. mean time 9^m 50^s, and its daily rate was 3^s.2 *gaining*.

13. March 22, 1836, at 3^h 30^m P. M. mean time nearly, in latitude 50' 50" N., and longitude by account 48° W., the following lunar observation was taken:—

Obs. Alt. Sun's L. L.	Obs. Alt. Moon's L. L.	Obs. Dist. N. L.
23° 50' 10"	57° 10' 30"	61° 40' 40"
Ind. cor. — 1 20	+ 2 10	— 0 40

The height of the eye above the sea was 12 feet: required the true longitude.

14. Feb. 3, 1836, at 7^h 10^m P. M. mean time nearly, in latitude 49° 12' S., and longitude 115° 28' E., the sun set by compass W. 10° 42' S.: required the variation.

15. Feb. 3, 1836, at 5^h 0^m A. M. mean time nearly, in latitude 51° 10' S., and longitude 125° 10' W., the compass bearing of the sun was E. 2° 10' N.; and the observed altitude of the sun's L. L. was 50° 20' 10"; the index correction was + 1' 50", and the height of the eye above the sea was 14 feet: required the variation.

16. Required the mean time of high water on May 19, 1836, A. M. and P. M. Change Tide 3^h 50^m P. M. app. time. Long. 110° W.

Elements for C, from Nautical Almanac 1836, with Answers.

1. N. 28° 23' 45" W. 453'.6
2. East 1186'.1
3. N. E. $\frac{1}{2}$ N.
4. Corrected courses E. b. S. $\frac{3}{4}$ S. 10' Dep. Course; N. b. E. $\frac{1}{2}$ E. 22'.5; S. $\frac{1}{2}$ E. 28'; W. $\frac{3}{4}$ N. 19'.4; S. b. W. $\frac{3}{4}$ W. 25'.1; N. b. E. $\frac{3}{4}$ E. 25'.7; W. b. N. $\frac{3}{4}$ N. 39'.3; W. b. N. $\frac{3}{4}$ N. 10'. Latitude in 34° 17' 54" S.; longitude in 17° 32' E.
5. R. A. of mean sun May 1, at Gr. mean noon, 2^h 37^m 46^s.2. R. A. γ Draconis 17^h 52^m 49^s.7, decl. 51° 30' 19" N. At 15^h 12^m 28^s; north of zenith 12° 48' 19".
6. Sun's decl. on Oct. 19, at Gr. mean noon, 10° 6' 23" S.; on Oct. 20, 10° 27' 59" S.; semid. 16' 6". Latitude 49° 47' 38" S.
7. Moon's decl. on Oct. 11, at 13^h, 13° 47' 30" S., at 14^h, 14° 1' 48" S. Moon's hor. semid. on Oct. 11, at Gr. mean midn. 16' 0".2, on Oct. 12, at Gr. mean noon 16' 3".6; corresponding hor. par. 58' 43".8 and 58' 56". Latitude 35° 33' 51" N.
8. Decl. α Arietis 22° 41' 5" N. Latitude 72° 30' 30" N.
9. Decl. of α Urs. Maj. 62° 37' 56" N. Latitude 40° 51' 53" N.
10. R. A. of mean sun on July 6, at Gr. mean noon, 6^h 57^m 59^s.01. Lat. 68° 46' N.
11. Sun's decl. on April 10, at Gr. mean noon, 8° 3' 56" N., on April 11 8° 26' 0" N.; semid. 15' 58". Arc. (1) 44° 45' 45". Arc (2) 86° 39' 30". Arc (3) 66° 12' 30". Latitude 56° 56' 26" N.
12. Sun's decl. on May 10, at Gr. mean noon, 17° 42' 16" N.; Eq. T. 3^m 51^s.4 S., sun's semid. 15' 51". Longitude 51° 51' 0" E.
13. Sun's decl. on March 22, at Gr. mean noon, 0^h 45^m 45^s N.; on March 23 1° 9' 24" N.; cor. Eq. T. 6^m 57^s.6 A and 6^m 39^s.2 A; sun's semid. 16' 3". Moon's hor. semid. on March 22, at Gr. mean noon, 14' 49".9, at Gr. mean midn. 14' 48".0; cor. hor. par. 54' 25".6, and 54' 18".6. True dist. 62° 11' 52"; dist. from Naut. Alm. at VI. 61° 48' 40", at IX. 63° 10' 27". Hour angle 3^h 25^m 14". Longitude 49° 44' 15" W.
14. Sun's decl. on Feb. 2, at Gr. mean noon, 17° 0' 5" N., on Feb. 3, 16° 42' 45" S. Tr. bearing W. 26° 7' 30" S. Variation 15° 25' 30" W.
15. Sun's decl. on Feb. 3, at Gr. mean noon, 16° 42' 45" S., on Feb. 4, 16° 25' 8" S.; semid. 16' 15". Tr. bearing S. 69° 53' 45" E. Variation 22° 10' 40" E.
16. Moon's Gr. mer. passage on May 19, 3^h 7^m, on May 18 2^h 17^m; semid. 14' 47". Eq. T. 4^m A to M. T. High water 5^h 58^m A. M., and 6^h 23^m P. M.

D.

1. Required the course and distance from A to B. Lat. A $71^{\circ} 50' S.$, long. A $14^{\circ} 25' W.$; lat. B $66^{\circ} 42' S.$, long. B $20^{\circ} 10' W.$

2. Sailed from A due West 478 miles; required the latitude and longitude in; lat. A $65^{\circ} 12' S.$, long. A $14^{\circ} 25' E.$

3. A point of land bore S. W. $\frac{1}{2}$ S. and a current run in the intermediate space S. $\frac{1}{4}$ E. 3.7 miles an hour; how must I steer a boat to fetch the point, supposing I can pull in still water 5.9 miles an hour?

4. Feb. 1, 1836, at noon, a point of land in latitude $49^{\circ} 56' S.$, and longitude $7^{\circ} 12' E.$ bore by compass W. b. S. $\frac{1}{2}$ S. distant 19 miles (variation $1^{\circ} \frac{3}{4} E.$); afterwards sailed as by the following log account: required the latitude and longitude in on Feb. 2, at noon.

H.	K.	$\frac{1}{10th.}$	Course.	Winds.	Lee-way.	
1	4	2	S.S.W. $\frac{1}{2}$ W.	West.	$2\frac{3}{4}$	P.M.
2	4	5				
3	3	7				
4	3	6				
5	4	0				
6	3	7	S.S.E.	East.	$2\frac{1}{4}$	Variation $1\frac{3}{4} E.$
7	4	3				
8	4	5				
9	4	7				
10	8	4	W. $\frac{1}{2}$ N.	North.	0	
11	9	2				
12	10	3				
						Remarks in H. M. S. Feb. 2, 1836.
1	10	5	..	..	..	A.M.
2	10	6				
3	10	4				
4	11	5	W.S.W.	S. $\frac{1}{2}$ W.	$2\frac{1}{2}$	
5	4	6				
6	3	7	..	..	..	During the 24 hours a current set the ship N.N.E. $\frac{1}{2}$ E. 24 miles.
7	3	2				
8	3	4				
9	3	6				
10	4	0				
11	4	5				
12	4	6				

5. What stars will pass the meridian of Greenwich between $4^h 4^m$ P.M., and $11^h 0^m$ P.M., on Feb. 3, 1836?

6. On Nov. 8, 1836, in longitude $89^{\circ} 40' E.$, the observed meridian altitude of the sun's L. L. was $40^{\circ} 20' 30''$ (zenith S. of the sun); the index correction was $-5' 20''$, and the height of the eye above the sea was 22 feet: required the latitude.

7. March 8, 1836, at 5^h A.M., in longitude $59^{\circ} 10' E.$, the observed meridian altitude of the moon's L. L. was $41^{\circ} 25' 30''$ (zenith N. of the moon); the index correction was $+5' 20''$; and the height of the eye above the sea was 18 feet: required the latitude.

8. March 20, 1836, the observed meridian altitude of the star Regulus was $39^{\circ} 20' 50''$ (zenith N. of the star); the index correction was $+3' 50''$, and the height of the eye above the sea was 20 feet: required the latitude.

9. July 7, 1836, the observed meridian altitude of the star α Ursæ Majoris, under the North Pole, was $30^{\circ} 20' 50''$; the index correction was $-3' 20''$, and the height of the eye above the sea was 23 feet: required the latitude.

10. Feb. 2, 1836, at $3^h 50^m$ A.M., in longitude $103^{\circ} 50' W.$, the observed altitude of the Pole Star was $47^{\circ} 52' 25''$; the index correction was $-2' 30''$, and the height of the eye above the sea was 25 feet: required the latitude.

11. On April 12, 1836, the following double altitude was observed :—

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L. L.	Tr. Bearing.
10 ^h 45 ^m A.M.	7 ^h 30 ^m 20 ^s	53° 0' 20"	S. E. b. S.
2 45 P.M.	11 29 40	40 59 10	S. W. b. W. $\frac{1}{4}$ W.

The run of the ship in the interval was S. S. E. 25 miles; the index correction was $-5' 20''$; and the height of the eye above the sea was 14 feet: required the true latitude; at the second observation, the latitude by account being $40^{\circ} 29' N.$, and the longitude $35^{\circ} 45' E.$

12. March 12, 1836, at 4^h 10^m P.M., in latitude $50^{\circ} 48' N.$, and longitude by account $65^{\circ} E.$, when a timekeeper No. 10 shewed 11^h 50^m 20^s, the observed altitude of the sun's L. L. was $14^{\circ} 50' 10''$; the index correction was $-2' 20''$, and the height of the eye above the sea was 18 feet: required the true longitude.

On Feb. 25, 1836, at Gr. mean noon, No. 10 was *slow* on Gr. mean time 1^m 40^s.2, and its daily rate was 3^s.5 *gaining*.

13. April 19, 1836, at 8^h 40^m A. M. mean time nearly, in latitude $35^{\circ} 10' N.$, and longitude by account $89^{\circ} 35' W.$, the following lunar observation was taken.

Obs. Alt. Sun's L. L.	Obs. Alt. Moon's L. L.	Obs. Dist. N. L.
37° 2' 40"	10° 6' 30"	40° 55' 10"
Ind cor. — 0 50	— 2 40	— 0 50

The height of the eye above the sea was 14 feet: required the true longitude.

14. Sept. 2, 1836, at 6^h 27^m A.M. in latitude $40^{\circ} 16' S.$, and longitude $110^{\circ} 13' E.$, the sun rose by compass E. $10^{\circ} 16' N.$: required the variation of the compass.

15. Aug. 26, 1836, at 5^h 30^m P.M. in latitude $50^{\circ} 15' N.$, and longitude $75^{\circ} 30' W.$, the compass bearing of the sun was S. $80^{\circ} 10' W.$, and the observed altitude of the sun's L. L. was at the same time $11^{\circ} 30' 15''$; the index correction was $-4' 10''$, and the height of the eye above the sea was 18 feet: required the variation of the compass.

16. Required the time of high water at A on Aug. 5, 1836, both A. M. and P. M. Change Tide at A 5^h 40^m P. M. App. T. Long. A $110^{\circ} 20' E.$

Elements for D, from Nautical Almanac 1836, with Answers.

1. N. $21^{\circ} 31' 15'' W.$ Distance 331 $\frac{1}{2}$ miles.
2. Lat. in $65^{\circ} 12' S.$ Long. in $4^{\circ} 35' W.$
3. S. W. b. W. $\frac{3}{4} W.$
4. Corrected courses E. $\frac{1}{4} S.$ 19' Dep. course; S. b. W. $\frac{1}{2} W.$ 20'; S. S. W. 17'. 2; N. W. b. W. $\frac{3}{4} W.$ 59'. 4; N. W. b. W. $\frac{3}{4} W.$ 43'. 1; N. E. $\frac{1}{4} E.$ 24'. Latitude in $49^{\circ} 32' S.$ longitude in $5^{\circ} 27' E.$
5. R. A. of mean sun Feb. 3, at Gr. mean noon, 20^h 50^m 49^s.45; R. A. α Columbæ 5^h 35^m 43^s.4; R. A. β Geminorum 7^h 35^m 17^s.2. From α Columbæ to β Geminorum inclusive.
6. Sun's decl. on Nov. 7, at Gr. mean noon, $16^{\circ} 23' 48'' S.$, on Nov. 8 $16^{\circ} 41' 19'' S.$; semid. $16' 10''$. Latitude $66^{\circ} 11' 4'' S.$
7. Moon's decl. on March 7, at Gr. mean time 13^h, $16^{\circ} 24' 24.6'' S.$, at 14^h $16^{\circ} 37' 19.7'' S.$; moon's semid. on March 7, Gr. mean midn. $16' 5''$, on March 8, at Gr. mean noon, $16' 6'' .3$; corresponding hor. par. $59' 1'' .2$ and $59' 6'' .0$ Lat. $31^{\circ} 9' 1'' N.$
8. Decl. α Leonis $12^{\circ} 45' 57'' N.$ Latitude $63^{\circ} 26' 52'' N.$
9. Decl. α Urs. Maj. $62^{\circ} 38' 18'' N.$ Latitude $57^{\circ} 32' 50'' N.$
10. R. A. of mean sun on Feb. 1, at Gr. mean noon, 20^h 42^m 56^s.34. Lat. $49^{\circ} 18' N.$
11. Sun's decl. April 11, at Gr. mean noon, $8^{\circ} 26' 0'' N.$, on April 12, $8^{\circ} 47' 56'' N.$, on April 13, $9^{\circ} 9' 42'' N.$; semid. $15' 58''$. Arc (1) $39^{\circ} 3' 45''$, Arc (2) $85^{\circ} 2' 15''$, Arc (3) $43^{\circ} 51' 0''$. Latitude $41^{\circ} 23' 7'' N.$
12. Sun's decl. on March 11, at Gr. mean noon $3^{\circ} 34' 45'' S.$, on March 12, $3^{\circ} 11' 10'' S.$; corresponding Eq. T. 10^m 9^s.41 A, and 9^m 53^s.08 A. Hour angle 4^h 6^m 5^s. Longitude $66^{\circ} 13' 30'' E.$
13. Sun's decl. on April 19, at Gr. mean noon, $11^{\circ} 17' 1'' N.$; on April 20, $11^{\circ} 37' 37'' N.$; cor. Eq. T. 0^m 59^s.3 S. and 1^m 12^s.4 S. Moon's hor. semid. on April 19, at Gr. mean noon, $14' 46'' .9$, on April 19, at Gr. mean midn., $14' 45'' .5$; cor. hor. par. $54' 14'' .7$ and $54' 9'' .7$. True dist. $40^{\circ} 49' 48''$; dist. at 0^h 39^m 37^s 14^s, at 11^h 40^m 59^s 14^s. Hour angle 20^h 31^m 22^s W. Longitude $92^{\circ} 14' W.$
14. Sun's decl. on Sept. 1, at Gr. mean noon, $8^{\circ} 11' 44'' N.$, on Sept. 2, $7^{\circ} 49' 50'' N.$ Tr. bearing E. $10^{\circ} 32' N.$ Variation $0^{\circ} 16' W.$
15. Sun's decl. on Aug. 26, at Gr. mean noon, $10^{\circ} 10' 5'' N.$, on Aug. 27, $9^{\circ} 59' 7'' N.$; semid. $15' 51''$. Tr. bearing N. $87^{\circ} 55' 15'' W.$ Variation $11^{\circ} 54' 45'' E.$
16. Moon's Gr. mer. passage on Aug. 5, at Gr. mean noon, 19^h 16^m, on Aug. 6, 18^h 29^m; moon's semid. $14' 53''$. Eq. T. 6^m S. from M. T. High Water 11^h 8^m A. M., and 11^h 32^m P. M.

E.

1. Required the course and distance from A to B. Lat. A $71^{\circ} 10' N.$ long. A $5^{\circ} 10' E.$, lat. B $65^{\circ} 40' N.$, long. B $0^{\circ} 25' W.$

2. Sailed from A due W. 1000 miles: required the latitude and longitude in. Lat. A $62^{\circ} 25' N.$, long. A $1^{\circ} 25' E.$

3. A ship bore from me N.E. $\frac{1}{2} E.$, and a current run in the intermediate space E. $\frac{1}{2} S.$ 5.2 mile per hour; how must I steer a boat to fetch the ship supposing I can pull in still water 8.2 miles per hour?

4. On Aug. 14, 1836, at noon, a point of land in latitude $50^{\circ} 10' N.$, and long. $25^{\circ} 10' W.$, bore by compass E.b.N. $\frac{1}{2} N.$ distant 25 miles (variation $2\frac{1}{2} E.$); afterwards sailed as by the following log account: required the latitude and longitude in on Aug. 15, at noon.

H.	K.	$\frac{1}{10ths}$	Course.	Wind.	Lee-way.	
1	3	5	N.W. $\frac{1}{2} W.$	N.N.E.	$1\frac{3}{4}$	P. M.
2	3	6				
3	4	2				
4	4	0				
5	5	2				
6	5	1	E. b. S. $\frac{3}{4} S.$	Do.	$2\frac{1}{4}$	Variation $2\frac{1}{2} E.$
7	5	0				
8	4	2				
9	4	6				
10	4	3				
11	4	2				
12	3	7				
						Remarks in H. M. S. Aug. 15, 1836.
1	3	5	E.S.E.	S. $\frac{1}{2} W.$	$2\frac{1}{2}$	A. M.
2	3	6				
3	3	2				
4	3	4				
5	3	5				
6	4	2	W. b. S.	Do.	$2\frac{3}{4}$	
7	4	7				
8	4	6				
9	4	2				
10	4	7				
11	4	6				
12	5	2				

5. What time will the fixed star α Aquilæ pass the meridian of St. Petersburg, on Oct. 14, 1836, and how far N. or S. of the zenith?

6. May 27, 1836, in longitude $56^{\circ} 25' E.$, the observed meridian altitude of the sun's L. L. was $37^{\circ} 42' 10''$ (zenith S. of the sun); the index correction was $-2' 50''$, and the height of the eye above the sea was 13 feet: required the latitude.

7. May 27, 1836, at $9^h 10^m$ P. M. mean time nearly, in longitude $85^{\circ} 50' W.$, the observed meridian altitude of the moon's L. L. was $47^{\circ} 10' 42''$ (zenith N. of the moon); the index correction was $+3' 10''$, and the height of the eye above the sea was 19 feet: required the latitude.

8. May 27, 1836, the observed meridian altitude of the star α Crucis was $75^{\circ} 10' 30''$ (zenith N. of the star); the index correction was $-1' 40''$, and the height of the eye above the sea was 14 feet: required the latitude.

9. Oct. 12, 1836, the observed meridian altitude of α Pavonis, under the South Pole, was $5^{\circ} 10' 20''$; the index correction was $+2' 50''$, and the height of the eye above the sea was 19 feet: required the latitude.

10. March 12, 1836, at $2^h 20^m$ A. M., in longitude $49^{\circ} 26' W.$, the observed altitude of Polaris (α Urs. Min.) was $60^{\circ} 25' 30''$; the index correction was $-4' 10''$, and the height of the eye above the sea was 13 feet: required the latitude.

11. April 21, 1836, the following double altitude of the sun was observed :—

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L.L.	Tr. Bearing.
10 ^h 0 ^m A.M.	10 ^h 2 ^m 35 ^s	44° 20' 40"	S.E. b. S.
11 24 A.M.	11 24 34	50 20 40	S. b. E.

The run of the ship in the interval was 0., the index correction was 0., and the height of the eye above the sea was 0.; required the true latitude at the second observation; the latitude by account being 50° 48' N., and the longitude 1° 6' W.

12. March 24, 1836, at 9^h 50^m A.M., mean time nearly, in latitude 50° 48' N., and longitude by account 20° W., a chronometer showed 10^h 2^m 15^s, and the observed altitude of the sun's L. L. was 26° 45' 10"; the index correction was +3' 20", and the height of the eye above the sea was 17 feet: required the true longitude.

March 18, 1836, at Gr. mean noon, the chronometer was *fast* on Gr. mean time 50^s.2, and its daily rate was 1^s.6 *losing*.

13. May 24, 1836, at 4^h 25^m P.M., mean time nearly, in latitude 50° 48' N., and longitude by account 3° 5' W., the following lunar observation was taken.

Obs. Alt. Sun's L.L.	Moon's L.L.	Dist. N.L.
30° 7' 30"	37° 32' 10"	101° 8' 20"
Ind. cor. +4 20	+4 40	-2 6

The height of the eye above the sea was 18 feet: required the true longitude.

14. May 6, 1836, at 5^h 30^m A.M., in latitude 50° 48' N., and longitude 47° 12' E., the sun rose by compass E. 2° 10' S.: required the variation.

15. Nov. 10, 1836, at 8^h 20^m A.M., in latitude 50° 30' N., and longitude 80° 19' E., the compass bearing of the sun was N. 85° 16' E., and the observed altitude of the sun's L. L. was 6° 10' 30"; the index correction was -3' 20", and the height of the eye above the sea was 15 feet: required the variation of the compass.

16. Required the mean time of high water on April 4 and 12 P. M. and A. M. Change Tide 4^h 10^m P.M. app. time. Long. A 100° E.

Elements for E, from Nautical Almanac 1836, with Answers.

1. S. 20° 22' 30" W. 352 miles.
2. Lat. 62° 25' N. Long. 34° 35' W.
3. N.N.E. $\frac{1}{2}$ E.
4. Corrected courses W. b. N. 25' Dep. Course; N.W. $\frac{1}{4}$ N. 20'.5; S. b. E. $\frac{1}{2}$ E. 31'.1; E.S.E. 21'.4; N.W. $\frac{1}{4}$ N. 28'.0. Lat. in 50° 12' 54" N. Long. in 25° 54' 0" W.
5. R. A. of mean sun, Oct. 14, at Gr. mean noon 13^h 32^m 14^s.53. R. A. α Aquilæ 19^h 42^m 48^s.5, decl. 8° 26' 34" N. At 6^h 9^m 53^s, S. of zenith 21° 59' 26" S.
6. Sun's decl. on May 26, at Gr. mean noon, 21° 11' 14" N.; on May 27, 21° 21' 21" N.; semid. 15' 48". Lat. 30° 49' 49" S.
7. Moon's decl. on May 27, at 14^h Gr. mean time, 10° 10' 11" S.; at 15^h, 10° 25' 35" S.: moon's hor. semid. on May 27, at Gr. mean midn., 16' 15".9; on May 28, at Gr. mean noon, 16' 22".6; cor. hor. par. 59' 41".4 and 60' 5".7. Lat. 31° 30' 34" N.
8. Decl. α Crucis 62° 11' 41" S. Lat. 47° 16' 35" S.
9. Decl. α Pavonis 57° 15' 21" S. Lat. 37° 43' 48" S.
10. R. A. mean sun, March 11, at Gr. mean noon, 23^h 16^m 41^s.96. Lat. 61° 50' N.
11. Sun's decl. on April 20, at Gr. mean noon, 11° 37' 37".5 N., on April 21, 11° 55' 2".1 N.; semid. 15' 55". Arc. (1) 20° 2' 45". (2) 87° 47' 45". (3) 62° 22' 45". Lat. 50° 45' 34" N.
12. Sun's decl. on March 23, at Gr. mean noon, 1° 9' 24" N., on March 25, 1° 33' 1' N.; corresponding Eq. T. 6^m 39^s.2 A., and 6^m 20^s.7 A.; semid. 16' 3". Hour angle 20^h 53^m 8^s. Longitude 15° 31' W.
13. Sun's decl. on May 24, at Gr. mean noon, 20° 49' 54" N.; on May 25, 21° 0' 45" N., cor. Eq. T. 3^m 29^s.2 S. and 3^m 23^s.6 S., sun's semid. 15' 48"; moon's hor. semid. on May 24, at Gr. mean noon, 15' 23".2, at Gr. mean midn. 15' 30".3; corresponding hor. par. 56' 27".8, and 56' 54".0. True dist. 101° 3' 31"; dist. at III., 100° 18' 43", at VI., 101° 48' 13". Hour angle 4^h 28^m 32". Longitude 1° 15' 30" W.
14. Sun's decl. on May 5, at Gr. mean noon, 16° 20' 35" N., on May 6, 16° 37' 28". True bearing E. 26° 43' 30" N. Variation 28° 53' 30" W.
15. Sun's decl. on Nov. 9, at Gr. mean noon, 16° 58' 33" S.; on Nov. 10, 17° 15' 30" S.; semid. 16' 11". Tr. bearing N. 126° 43' 30" E. Variation 41° 27' 30" E.
16. Moon's Gr. mer. passage on April 4, 14^h 49^m; on April 3, 13^h 54^m; semid. 16' 17". Eq. T. 3^m *subt.* from M. T. High Water 5^h 13^m A.M., and 5^h 40^m P.M. Moon's Gr. mer. pass. April 12, 22^h 17^m; April 11, 21^h 31^m. Semid. 15' 35". Eq. T. 1^m *subt.* from M. T. High Water 1^h 30^m A.M., and 1^h 53^m P. M.

F.

1. Required the course and distance from A to B. Lat. A $67^{\circ} 20' S.$, long. A $18^{\circ} 25' W.$; lat. B $61^{\circ} 42' S.$, long. B $22^{\circ} 36' W.$

2. Required the course and distance from A to B. Lat. A $80^{\circ} 10' N.$, long. A $110^{\circ} 42' E.$; lat. B $80^{\circ} 10' N.$, long. B $115^{\circ} 42' E.$

3. A ship bore from me N.E. b. N. $\frac{1}{2} N.$, and a current run in the intermediate space E. $\frac{1}{2} S.$ 4.6 miles an hour; how must I steer a boat to fetch the ship, supposing I can pull in still water 7.8 miles an hour?

4. May 16, 1836, at noon, a point of land in latitude $62^{\circ} 48' N.$, and longitude $83^{\circ} 17' W.$ bore by compass N. b. E $\frac{1}{4} E.$ distant 16 miles (variation of compass $2\frac{1}{4} E.$); afterwards sailed as by the following log account: required the latitude and longitude in on May 17, at noon.

H.	K.	$\frac{1}{10} \text{ lbs.}$	Course.	Wind.	Lee-way.	
1	4	2	N. b. E.	E.	$2\frac{1}{4}$	P.M.
2	3	9				
3	4	5				
4	4	5				
5	4	5	N.E. $\frac{3}{4} E.$	N. b. W.	$3\frac{1}{2}$	Variation of the Compass $2\frac{1}{4} E.$
6	5	0				
7	5	1				
8	4	8				
9	5	7	W. $\frac{3}{4} N.$	N.	$1\frac{1}{4}$	
10	6	2				
11	6	3				
12	6	4				
						Remarks in H. M. S. May 17, 1836.
1	6	5				
2	5	9	E.S.E.	S.	3	A.M.
3	5	8				
4	5	7				
5	4	9	S.E. $\frac{1}{2} S.$	N. b. E.	0	
6	4	8	..	..	..	A current set the ship the last 5 hours
7	4	8				$4\frac{1}{2}$ miles an hour E.N.E.
8	5	1				
9	6	0	W. $\frac{3}{4} S.$	N. b. W.	$3\frac{1}{4}$	
10	6	3				
11	6	3				
12	6	3				

5. What bright stars will pass the meridian of Greenwich between 10^h P.M., on May 6, 1836, and 1^h A.M. on May 7, 1836?

6. May 20, 1836, in longitude $78^{\circ} 29' W.$, the observed meridian altitude of the sun's L.L. was $39^{\circ} 26' 47''$ (zenith N. of the sun); the index correction was $+7' 28''$, and the height of the eye above the sea was 22 feet: required the latitude.

7. April 19, 1836, at 2^h 18^m A.M., in longitude $120^{\circ} 12' E.$, the observed meridian altitude of the moon's L. L. was $40^{\circ} 19' 27''$ (zenith N. of the moon); the index correction was $+7' 28''$, and the height of the eye above the sea was 12 feet: required the latitude.

8. May 27, 1836, the observed meridian altitude of the star α Hydræ was $30^{\circ} 28' 53''$ (zenith N. of the star); the index correction was $-7' 38''$, and the height of the eye above the sea was 11 feet: required the latitude.

9. June 16, 1836, the observed meridian altitude of the star α Eridani, under the South Pole, was $20^{\circ} 47' 56''$; the index correction was $-2' 59''$, and the height of the eye above the sea was 23 feet: required the latitude.

10. On March 10, 1836, at 10^h 28^m P.M. mean time, in longitude $83^{\circ} 18' W.$, the observed altitude of the star α Urs. Min. was $52^{\circ} 10' 37''$; the index correction was $-5' 29''$, and the height of the eye above the sea was 12 feet: required the latitude.

11. On March 13, 1836, the following double altitude of the sun was observed.

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L.L.	Tr. Bearing.
7 ^h 0 ^m A.M.	7 ^h 2 ^m 20 ^s	7° 20' 15"	E. b. S. $\frac{1}{4}$ S.
11 0 A.M.	11 2 20	41 10 10	S.S.E. $\frac{1}{2}$ E.

The run of the ship in the interval was N.W. 18 miles; the index correction was $-3'10''$ and the height of the eye above the sea was 15 feet; required the latitude at the second observation; the latitude by account being $42^{\circ} 10' N.$, and the longitude $45^{\circ} 19' W.$

12. March 1, 1836, at 7^h 44^m P.M., in latitude $44^{\circ} 25' N.$, and longitude $58^{\circ} E.$, when a chronometer No. 10 showed 5^h 10^m 42^s.5, the observed altitude of fixed star α Arietis was $30^{\circ} 10' 10''$, W. of meridian; the index correction was $+3' 10''$, and the height of the eye above the sea was 19 feet: required the true longitude.

On Feb. 20, 1836, at Gr. noon, No. 10 was *fast* on Greenwich mean time 1^h 10^m 15^s, and its daily rate was 1.5 seconds *losing*.

13. May 20, 1836, at 4^h 20^m P.M. mean time nearly, in latitude $50^{\circ} 48' N.$, and longitude by account $3^{\circ} 20' W.$, the following lunar observation was taken.

Obs. Alt. Sun's L.L.	Moon's L.L.	Obs. Dist. N.L.
30° 53' 50"	65° 0' 40"	55° 43' 58"
Ind. cor. + 4 11	0 0	— 36 6

The height of the eye above the sea was 18 feet: required the true longitude.

14. Sept. 28, 1836, at 5^h 51^m A. M., in latitude $47^{\circ} 25' S.$, and longitude $75^{\circ} 25' E.$, the sun rose by compass E. $12^{\circ} 10' S.$: required the variation.

15. April 13, 1836, at 7^h 10^m A.M., in latitude $48^{\circ} 52' N.$, and longitude $152^{\circ} 12' E.$ the compass bearing of the sun was S. $68^{\circ} 25' E.$, and the observed altitude of the sun's L. L. at the time was $14^{\circ} 45' 10''$; the index correction was $-3' 50''$, and the height of the eye above the sea was 20 feet: required the variation.

16. Required the time of high water on May 26, 1836, A. M. and P. M.

Change Tide... 4^h 10^m P.M. App. T. Long... 92° E.

Elements for F, from Nautical Almanac 1836, with Answers.

1. N. $17^{\circ} 38' 45'' W.$ 354.7 miles.
2. East 51.2 miles.
3. N. $\frac{1}{2} W.$
4. Corrected courses S.W. $\frac{1}{4} S.$ 16' Dep. Course; N. b. E. $17'.1$; S.E. b. E. $\frac{1}{4} E.$ 19'.4. W. b. N. $\frac{1}{4} N.$ 31'.1; E. b. S. $\frac{1}{4} S.$ 17'.4; S. b. E. $\frac{1}{4} E.$ 19'.6; W.S.W. $\frac{1}{4} W.$ 24'.9; E. $\frac{1}{4} S.$ 22'.5. Lat. in $62^{\circ} 18' N.$ Long. in $83^{\circ} 15' W.$
5. R. A. of mean sun, May 6, at Gr. mean noon, $2^h 57^m 29^s.0$; R.A. α Virginis $13^h 16^m 35^s$; R. A. β Scorpii $15^h 55^m 56.4$. From α Virginis to β Scorpii inclusive.
6. Sun's decl. on May 20, at Gr. mean noon, $20^{\circ} 2' 57'' N.$; on May 21, $20^{\circ} 15' 13'' N.$; sun's semid. $15' 49''$. Lat $70^{\circ} 21' 12'' N.$
7. Moon's decl. on April 18, at 6^h , $21^{\circ} 4' 53'' N.$; at 7^h , $21^{\circ} 13' 52'' N.$; moon's hor. semid. α . April 18, at Gr. mean noon, $14' 51''$, on April 18, at Gr. mean midn., $14' 48''.8$: cor. hor. par. $54' 29''.8$ and $54' 21''.5$. Lat. $69^{\circ} 48' 45'' N.$
8. Decl. α Hydræ $7^{\circ} 57' 7'' S.$ Lat. $51^{\circ} 46' 33'' N.$
9. Decl. α Eridani $58^{\circ} 3' 57'' S.$ Lat. $52^{\circ} 33' 44'' S.$
10. R. A. mean sun, March 10, at Gr. mean noon, $23^h 12^m 45^s.40$. Lat. $53^{\circ} 2' N.$
11. Sun's decl. March 12, at Gr. mean noon, $2^{\circ} 11' 10'' S.$; March 13, $2^{\circ} 47' 32'' S.$; March 14, $2^{\circ} 23' 53'' S.$; sun's semid. $16' 6''$. Lat. $43^{\circ} 19' 48'' N.$
12. R. A. mean sun, on March 1, at Gr. mean noon, $22^h 37^m 16^s.43$; decl. of α Arietis $22^{\circ} 41' 2'' N.$; R. A. α Arietis $1^h 57^m 55^s$. Hour angle $4^h 37^m 33^s W.$ Longitude $59^{\circ} 12' 30'' E.$
13. Sun's decl. on May 20, at Gr. mean noon, $20^{\circ} 2' 57'' N.$; on May 21, $20^{\circ} 15' 13'' N.$, cor. Eq. T. $3^m 46^s.4 S.$ and $3^m 42^s.9 S.$, moon's hor. semid. on May 20, at Gr. mean noon, $14' 46''.5$, on May 20, at Gr. mean midn. $14' 48''.9$; corresponding hor. par. $54' 13''.2$, and $54' 22''.1$. True dist. $55^{\circ} 39' 43''$. Dist. at III, $55^{\circ} 2' 57''$, at VI, $56^{\circ} 24' 58''$. Hour angle $4^h 19^m 58^s$. Longitude $1^{\circ} 7' 15'' W.$
14. Sun's decl. on Sept. 27, at Gr. mean noon, $1^{\circ} 44' 47'' S.$, on Sept. 28, $2^{\circ} 8' 11'' S.$ Tr. bearing E. $2^{\circ} 53' 15'' S.$ Variation $9^{\circ} 16' 45'' W.$
15. Sun's decl. on April 12 at Gr. mean noon, $8^{\circ} 47' 56'' N.$; on April 13, $9^{\circ} 9' 42'' N.$; sun's semid. $15' 58''$. Tr. bearing N. $93^{\circ} 22' 15'' E.$ Variation $18^{\circ} 12' 45'' W.$
16. Moon's Gr. mer. passage on May 26, $8^h 37^m$; on May 25, $7^h 51^m$; semid. $15' 53''$ Eq. T. $3^m A.$ to M. T. High Water $0^h 19^m P.M.$ No Tide A.M.

G.

1. Required the course and distance from A to B. Lat. A $60^{\circ} 25' S.$, long. A $3^{\circ} 10' E.$; lat. B. $55^{\circ} 20' S.$, long. B. $10^{\circ} 0' E.$

2. Required the course and distance from A to B. Lat. A $53^{\circ} 42' N.$, long. A $2^{\circ} 55' W.$; lat. B $53^{\circ} 42' N.$, long. B $4^{\circ} 10' W.$

3. A ship bore from me E. $\frac{3}{4} N.$ and a current set in the intermediate space S. E. 4.7 miles an hour; how must I steer a boat to fetch the ship, supposing I can pull in still water 7.2 miles an hour?

4. June 7, 1836, at noon, a point of land in latitude $42^{\circ} 12' S.$ and longitude $42^{\circ} 58' W.$ bore by compass E. b. N. $\frac{1}{2} N.$ distant 21 miles (variation $1^{\circ} \frac{3}{4} W.$); afterwards sailed as by the following log account: required the latitude and longitude in on June 8, at noon.

H.	K.	¹ 10ths.	Course.	Wind.	Lee- way.	
1	4	2	S.S.E. $\frac{1}{2}$ E.	East.	2	P. M.
2	4	3				
3	5	0				
4	5	2				
5	4	0	N.N.E.	Do.	$2\frac{1}{4}$	Variation $1\frac{3}{4}$ W.
6	4	1				
7	3	8				
8	3	5				
9	3	2	S.W. $\frac{1}{2}$ W.	W.N.W.	$1\frac{3}{4}$	
10	3	5				
11	3	6				
12	4	0				
						Remarks in H. M. S. June 8, 1836.
1	4	2	N. $\frac{1}{4}$ E.	Do.	$2\frac{1}{4}$	A. M.
2	4	3				
3	4	4				
4	4	5				
5	6	2	S. S. W.	West.	$\frac{1}{2}$	A current set the ship during the whole day 26 miles W. S. W.
6	6	4	
7	6	2	
8	6	5	
9	6	2	N.N.W. $\frac{1}{2}$ N.	Do.	$\frac{3}{4}$	
10	5	7				
11	5	3				
12	5	4				

5. At what time will α Crucis pass the meridian of St. Helena on June 8, 1836, and how far N. or S. of the zenith?

6. June 8, 1836, in longitude $52^{\circ} 10' E.$, the observed meridian altitude of the sun's L. L. was $57^{\circ} 2' 40''$ (zenith N. of the sun); the index correction was $+ 2' 10''$, and the height of the eye above the sea was 10 feet: required the latitude.

7. June 8, 1836, at $9^h 2^m$ A. M. mean time nearly, in longitude $70^{\circ} 22' W.$, the observed meridian altitude of the moon's L. L. was $32^{\circ} 10' 50''$ (zenith S. of the moon); the index correction was $-1' 50''$, and the height of the eye above the sea was 12 feet: required the latitude.

8. June 10, 1836, the observed meridian altitude of α Cygni was $20^{\circ} 10' 40''$ (zenith S. of the star); the index correction was $+ 3' 10''$, and the height of the eye above the sea was 15 feet: required the latitude.

9. June 10, 1836, the observed meridian altitude of α Ursæ Majoris, under the North Pole, was $11^{\circ} 10' 50''$; the index correction was $- 3' 40''$, and the height of the eye above the sea was 16 feet: required the latitude.

10. June 10, 1836, at $1^h 50^m$ A. M. mean time, in longitude $35^{\circ} 26' E.$, the observed altitude of α Urs. Min. (Polaris) was $60^{\circ} 25' 10''$; the index correction was $- 1' 10''$, and the height of the eye above the sea was 13 feet: required the latitude.

11. April 11, 1836, the following double altitude of the sun was observed:—

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L.L.	Tr. Bearing.
9 ^h 46 ^m A.M.	0 ^h 44 ^m 53 ^s	41° 30' 20"	S.E.
14 15 A.M.	2 14 48	48 32 15	S.S.E.

The run of the ship in the interval was S. E. b. E. 18 miles; the index correction was $-1' 20''$, and the height of the eye above the sea was 17 feet; required the true latitude, the latitude by account being 42° N., and the longitude $80^{\circ} 5'$ W.

12. Feb. 10, 1836, at 9^h 5^m P.M. mean time nearly, in latitude $28^{\circ} 20'$ N., and longitude by account $31^{\circ} 2'$ W., a chronometer showed $11^h 16^m 25^s$, and the observed altitude of the star α Leonis (Regulus) was $41^{\circ} 55' 10''$ E. of meridian; the index correction was $+1' 20''$, and the height of the eye above the sea was 25 feet: required the true longitude.

Feb. 1, 1836, at Gr. mean noon, the chronometer was *fast* on Greenwich mean time $5^m 20^s.6$, and its daily rate was 2.7 seconds *losing*.

13. May 24, 1836, at 8^h 1^m P.M. mean time nearly, in latitude $50^{\circ} 48'$ N., and longitude by account $10^{\circ} 0'$ W. the following lunar observation was taken:—

Obs. Alt. of Venus bearing W.	Moon's L.L.	Obs. Dist. N.L.
$31^{\circ} 50' 20''$	$43^{\circ} 46' 20''$	$57^{\circ} 42' 57''$
Index cor. $+ 4 20$	$+ 4 25$	$+ 0 10$

The height of the eye above the sea was 19 feet: required the true longitude.

14. June 15, 1836, at 8^h 10^m P.M. mean time nearly, in latitude $50^{\circ} 48'$ N., and longitude $100^{\circ} 14'$ W., the sun set by compass W. $21^{\circ} 47' 10''$ N.: required the variation.

15. June 15, 1836, at 9^h 39^m A.M. mean time nearly, in latitude $50^{\circ} 48'$ N., and longitude by account 3° W., the compass bearing of the sun was S. $38^{\circ} 30'$ E., and the observed altitude of the sun's L.L. was $50^{\circ} 13' 10''$; the index correction was $-4' 10''$, and the height of the eye above the sea was 20 feet: required the variation of the compass.

16. Required the mean time of high water on Aug. 26, 1836, A.M. and P.M. Change Tide $2^h 15^m$ P.M. app. time. Long. $55^{\circ} 20'$ E.

Elements for G, from Nautical Almanac 1836, with Answers.

1. N. $35^{\circ} 29' 30''$ E. $374'.6$
2. West 44.4
3. N. E. $\frac{1}{2}$ E.
4. Corrected courses S. W. $\frac{3}{4}$ W. $21'$ Dep. Course; S. S. E. $\frac{1}{4}$ E. $22'.7$; N. N. W. $14'.6$; S. b. W. $15'.3$; N. b. E. $13'.2$; S. $\frac{1}{4}$ E. $25'.3$; N. N. W. $\frac{1}{2}$ W. $22'.6$; S. W. $\frac{1}{4}$ W. $26'$. Lat. in $42^{\circ} 56'$ S. Long. in $43^{\circ} 55'$ W.
5. R. A. of mean sun, June 8, at Gr. mean noon, $5^h 7^m 35^s.38$; R. A. α Crucis, $12^h 17^m 32^s.8$, decl. $62^{\circ} 11' 42''$ S. At $7^h 8^m 40^s$; S. of zenith $46^{\circ} 16' 42''$.
6. Sun's decl. on June 7, at Gr. mean noon $22^{\circ} 47' 42''$ N.; on June 8, $22^{\circ} 53' 13''$ N.; semid. $15' 46''$. Lat. $55^{\circ} 35' 27''$ N.
7. Moon's decl. on June 8, at 1^h Gr. mean time, $2^{\circ} 56' 54''$ N.; at 2^h, $3^{\circ} 11' 8''$ N.; moon's hor. semid. on June 8, at Gr. mean noon, $15' 11''.6$ at Gr. midn. $15' 6''.8$; cor. hor. par. $55' 45''.4$ and $55' 27''.7$. Lat. $53^{\circ} 46' 27''$ S.
8. Decl. α Cygni $44^{\circ} 41' 37''$ N. Lat. $25^{\circ} 10' 59''$ S.
9. Decl. α Urs. Majoris $62^{\circ} 38' 21''$ N. Latitude $38^{\circ} 20' 3''$ N.
10. R. A. mean sun, June 9, at Gr. mean noon, $5^h 11^m 31^s.93$; Lat. $60^{\circ} 23'$ N.
11. Sun's decl. April 11, at Gr. mean noon, $8^{\circ} 26' 0''$ N., on April 12, $8^{\circ} 47' 56''$ N., sun's semid. $15' 58''$. Lat. $49^{\circ} 16' 27''$ N.
12. R. A. mean sun, on Feb. 10, at Gr. mean noon, $21^h 18^m 25^s.32$; R. A. α Leonis $9^h 59^m 39^s$; decl. α Leonis $12^{\circ} 45' 57''$ N.; Hour angle $20^h 43^m 39^s$ W. Longitude $27^{\circ} 6' 45''$ W.
13. R. A. mean sun, on May 24, at Gr. mean noon, $4^h 8^m 27^s.02$; R. A. Venus, on May 24, at Gr. mean noon, $7^h 21^m 36^s$; on May 25, $7^h 25^m 28^s$; cor. decl. of Venus, $25^{\circ} 7' 5''$ N. and $24^{\circ} 57' 41''$ N.; hor. par. $12''.6$: moon's hor. semid. on May 24, at Gr. mean noon, $15' 23''.2$; on May 25, $15' 30''.3$: corresponding hor. par. $56' 27''.8$ and $56' 54''.0$. True dist. $57^{\circ} 49' 25''$; dist. from Naut. Alm. at V. $56^{\circ} 36' 11''$, at IX. $58^{\circ} 6' 31''$. Hour angle $4^h 38^m 40^s$ W. Longitude $8^{\circ} 32' 15''$ W.
14. Sun's decl. on June 15, at Gr. mean noon, $23^{\circ} 20' 26''$ N. on June 16, $23^{\circ} 32' 41''$ N. Tr. bearing W. $38^{\circ} 51' 30''$ N. Variation $17^{\circ} 4' 20''$ E.
15. Sun's decl. on June 14, at Gr. mean noon, $23^{\circ} 17' 46''$ N.; on June 15, $23^{\circ} 20' 26''$ N., semid $15' 46''$. Tr. bearing N. $119^{\circ} 46' 45''$ E. Variation $21^{\circ} 43' 15''$ W.
16. Moon's Gr. mer. passage on August 26, $12^h 31^m$, Gr. mean time; on August 25, $11^h 38^m$; semid. $16' 14''$; Eq. Time 1^m *sub.* from mean time. High water $1^h 47^m$ A. M. and $2^h 14^m$ P.M.

H.

1. Required the course and distance from A to B. Lat. A $47^{\circ} 50' S.$, long. A $2^{\circ} 25' E.$; lat. B $42^{\circ} 26' S.$, long. B $1^{\circ} 40' E.$
2. Sailed from New York 356 miles due East; required the latitude and longitude in.
3. A ship bore from me E.S.E., and a current run in the intermediate space E. b. N. $\frac{1}{2} N.$ $4\frac{1}{2}$ miles per hour; how must I steer a boat to fetch the ship, supposing I can pull in still water $6\frac{3}{4}$ miles per hour?
4. Aug. 11, 1836, at noon, a point of land in latitude $56^{\circ} 11' S.$, and longitude $14^{\circ} 26' E.$ bore by compass N.N.E. $\frac{1}{2} E.$ distant 24 miles; afterwards sailed as by the following log account: required the latitude and longitude in, on Aug. 12, at noon.

H.	K.	$\frac{1}{10}$ Ths.	Course.	Wind.	Lee-way.	
1	3	5	N.N.W. $\frac{1}{2} W.$	N.E. $\frac{1}{2} N.$	2	P. M.
2	3	4				
3	3	2				
4	4	0				
5	4	2	E. b. S. $\frac{1}{2} S.$	Do.	$2\frac{1}{2}$	Variation $2\frac{1}{4} W.$
6	3	6				
7	3	7				
8	3	2				
9	3	5				
10	4	3	S. b. E. $\frac{1}{2} E.$	S.W.	$3\frac{1}{4}$	
11	4	5				
12	4	6				
						Remarks in H. M. S. Aug. 12, 1836.
1	8	2	N. $\frac{1}{2} E.$	E.S.E.	0	A.M.
2	8	6				
3	8	7				
4	9	0				
5	8	5				
6	8	4	S.W. $\frac{1}{4} W.$	S.S.E.	$2\frac{1}{4}$	A current set the ship 20 miles E.S.E. $\frac{1}{2} E.$
7	3	2				
8	3	3				
9	3	4				
10	3	5				
11	3	6				
12	3	7				

5. What bright fixed stars will pass the meridian of Paris between $9^h 10^m$ P.M. on Aug. 12, 1836, and $11^h 20^m$ P.M. on Aug. 12, 1836?

6. Aug. 12, 1836, in longitude $92^{\circ} 12' E.$, the observed meridian altitude of the sun's L. L. was $42^{\circ} 42' 10''$ (zenith S. of the sun); the index correction was $-2' 50''$, and the height of the eye above the sea was 17 feet: required the latitude.

7. Aug. 18, 1836, at $4^h 30^m$ P. M. mean time nearly, in longitude $82^{\circ} 16' E.$, the observed meridian altitude of the moon's L. L. was $33^{\circ} 10' 50''$ (zenith N. of the moon); the index correction was $-5' 40''$, and the height of the eye above the sea was 17 feet: required the latitude.

8. Aug. 15, 1836, the observed meridian altitude of α Cygni was $78^{\circ} 52' 10''$ (zenith N. of the star); the index correction was $+4' 10''$, and the height of the eye above the sea was 15 feet: required the latitude.

9. Aug. 13, 1836, the meridian altitude of α Cephei, under the North Pole, was $7^{\circ} 10' 40''$; the index correction was $-2' 25''$, and the height of the eye above the sea was 12 feet: required the latitude.

10. Aug. 15, 1836, at $2^h 20^m$ A.M., in longitude $56^{\circ} 10' E.$, the observed altitude of α Urs. Min. (Polaris) was $51^{\circ} 26' 10''$; the index correction was $+3' 50''$, and the height of the eye above the sea was 20 feet: required the latitude.

11. Oct. 15, 1836, the following double altitude of the sun was observed.

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L.L.	Tr. Bearing
11 ^h 20 ^m A.M.	11 ^h 15 ^m 50 ^s	27° 31' 50"	S. b. E.
1 20 P.M.	0 50 32	25 45 5	S.S.W.

The run of the ship in the interval was S. b. W. 14 miles; the index correction was +2' 55", and the height of the eye above the sea was 15 feet, required the true latitude at the second observation; the latitude by account being 51° N., and the longitude 22° 52' E.

12. April 28, 1836, at 8^h 10^m P. M. mean time nearly, in latitude 50° 15' N., and longitude by account 61° W., a chronometer showed 0^h 2^m 5^s, the observed altitude of β Geminorum (Pollux) was 46° 50' 20" W. of the meridian; the index correction was +1' 50", and the height of the eye above the sea was 17 feet: required the true longitude.

On April 14, at Greenwich mean noon, the chronometer was *slow* on Greenwich mean time 53^s.5, and its daily rate was 0^s.9 *losing*.

13. Aug. 21, 1836, at 7^h 50^m P. M. mean time nearly, in latitude 20° 15' N., and longitude by account 111° 15' W., the following lunar observation was taken.

Obs. Alt. α Pegasi E. of Mer.	Moon's L.L.	Obs. Dist. F.L.
15° 0' 40"	46° 20' 10"	85° 10' 40"
—1 40	+1 10	+0 40

The height of the eye above the sea was 19 feet: required the true longitude.

14. Oct. 28, 1836, at 8^h 30^m A.M. mean time nearly, in latitude 49° 40' N., and longitude 116° 12' W.; the compass bearing of the sun at rising was E. 3° 20' N.: required the variation.

15. Nov. 15, 1836, at 7^h 50^m P. M. mean time nearly, in latitude 48° 31' S., and longitude by account 142° 15' E.; the compass bearing of the sun was S. 99° 10' W., and the observed altitude of the sun's L. L. was 9° 58' 10"; the index correction was —1' 40", and the height of the eye above the sea was 11 feet: required the variation.

16. Required the mean time of high water at A on Sept. 8, 1836, A.M. and P.M. Change Tide at A, 3^h 50^m P.M. app. time. Long. A 61° E.

Elements for H, from Nautical Almanac 1836, with Answers.

1. N. 5° 35' 15" W. 325'.6 miles.
2. Latitude in 40° 42' N. Long. in 66° 9' 24" W.
3. S.E. $\frac{1}{4}$ S.
4. Corrected courses S. $\frac{1}{4}$ W. 24' Dep. Course; W. b. N. $\frac{1}{4}$ N. 14'.1; E. b. S. $\frac{3}{4}$ S. 18'.2; E. b. S. 13'.4; N. b. W. $\frac{3}{4}$ W. 43'.0; S.W. $\frac{1}{4}$ W. 29'.1; E. $\frac{3}{4}$ N. 20'. Lat. in 56° 16' S. Long. in 14° 24' E.
5. R. A. of mean sun Aug. 12, at Gr. mean noon, 9^h 23^m 51^s.6. R. A. β Lyrae 8^h 44^m 3^s.7; R. A. α Cygni 20^h 35^m 50^s.9. From β Lyrae to α Cygni inclusive.
6. Sun's decl. on Aug. 11, at Gr. mean noon, 15° 12' 52" N; on Aug. 12, 14° 54' 51" N.; semid. 15' 49". Lat. 32° 10' 28" S.
7. Moon's decl. on Aug. 17, at 23^h Gr. mean time, 13° 10' 5" S.; at 24^h, 13° 23' 53" S.; moon's hor. semid. on Aug. 17, at Gr. mean midn. 15' 42".7; on Aug. 18, 15' 47".3: cor. hor. par. 57' 39".5 and 57' 56".2. Lat. 42° 45' 44" N.
8. Decl. of α Cygni 44° 41' 59" N. Lat. 55° 49' 40" N.
9. Decl. of α Cephei 61° 53' 39" N. Lat. 35° 3' 48" N.
10. R. A. of mean sun, on Aug. 14, at Gr. mean noon, 9^h 31^m 44^s.75. Latitude 49° 55' N.
11. Sun's decl. Oct. 14, at Gr. mean noon, 8° 16' 16" S.; on Oct. 15, 8° 38' 33" S. semid. 15' 4". Lat. 53° 18' N.
12. R. A. mean sun, on April 28, at Gr. mean noon, 2^h 25^m 56^s.54; R. A. of β Geminorum 7^h 35^m 16^s; decl. 28° 25' 6" N.; Hour angle 3^h 19^m 15^s. Long. 54° 8' 45" W.
13. R. A. mean sun, on Aug. 21, at Gr. mean noon, 9^h 59^m 20^s.62; R. A. of α Pegasi 22° 56' 38"; decl. 14° 19' 41" N.; moon's hor. semid. on Aug. 21, at Gr. mean midn. 16' 16".8; on Aug. 22, at Gr. mean noon, 16' 19".7; corresponding hor. par. 56' 49".5 and 59' 55".3. True Dist. 84° 46' 12"; dist. at XII, 86° 23' 58"; at XV, 84° 44' 30". Hour angle 18^h 43^m 17^s. Longitude 109° 41' 15" W.
14. Sun's decl. on Oct. 28, at Gr. mean noon, 15° 14' 35" S.; on Oct. 29, 13° 34' 33" S. Tr. bearing E. 20° 49' 30" S. Variation 24° 9' 30" E.
15. Sun's decl. on Nov. 14, at Gr. mean noon, 18° 20' 15" S.; on Nov. 15, 18° 35' 39" S.; semid. 16' 12". Tr. bearing S. 73° 17' 15" W. Variation 24° 52' 45" W.
16. Moon's Gr. mer. passage on Sept. 8, 22^h 54^m; mean time on Sept. 7, 22^h 8^m; semid. 15' 0"; Eq. Time. 2^m A to mean time. High Water 1^h 45^m A.M. and 2^h 9^m P. M.

I.

1. Required the course and distance from A to B. Lat. A $47^{\circ} 50' S.$, long. A $42^{\circ} 16' E.$; lat. B $40^{\circ} 49' S.$, long. B $46^{\circ} 25' E.$

2. Required the course and distance from A to B. Lat. A $58^{\circ} 10' N.$, long. A $72^{\circ} 12' E.$; lat. B $58^{\circ} 10' N.$, long. B $65^{\circ} 10' E.$

3. A ship bore from me N. E. $\frac{1}{4} E.$, and a current run in the intermediate space E. b. S. 5 miles an hour: how must I steer a boat to fetch the ship, supposing I can pull in still water 7.5 miles an hour?

4. Sept. 16, 1836, at noon, a point of land in latitude $47^{\circ} 10' N.$, and longitude $15^{\circ} 32' W.$, bore by compass E. b. N. $\frac{1}{2} N.$ (variation $2\frac{1}{4} E.$), distant 16 miles; afterwards sailed as by the following log account.

H.	K.	$\frac{1}{10} \text{ths.}$	Course.	Wind.	Lee-way.	
1	3	5	N.W. $\frac{1}{2} W$	N.N.E.	$1\frac{3}{4}$	P.M.
2	3	6				
3	3	2				
4	4	0	E. $\frac{1}{4} S.$	Do.	2	Variation $2\frac{1}{4} E.$
5	4	2				
6	4	3				
7	4	5	S. b. E. $\frac{3}{4} E.$	S.W.	$2\frac{1}{2}$	
8	4	6				
9	5	2				
10	5	0				
11	5	3				
12	5	6				
						Remarks in H. M. S. Sept. 17, 1836.
1	3	6	W. b. N. $\frac{3}{4} N.$	Do.	$2\frac{3}{4}$	A.M.
2	3	5				
3	3	2				
4	3	6	S. $\frac{1}{4} E.$	W.S.W.	$2\frac{1}{4}$	A current set the ship East 20 miles.
5	3	7				
6	4	2				
7	4	3	N.W.	Do.	$2\frac{1}{4}$	
8	4	5				
9	4	6				
10	4	7				
11	5	2				
12	6	0				

5. What bright fixed stars will pass the meridian of New York between 9^h P.M. and 11^h P.M. on Sept. 16, 1836?

6. Aug. 29, 1836, in longitude $100^{\circ} 5' E.$, the observed meridian altitude of the sun's L.L. was $43^{\circ} 20' 10''$ (zenith N. of the sun); the index correction was $+3' 10''$, and the height of the eye above the sea was 18 feet: required the latitude.

7. Sept. 18, 1836, at 6^h 30^m P.M. mean time nearly, in longitude $142^{\circ} 20' E.$, the observed meridian altitude of the moon's L.L. was $22^{\circ} 10' 50''$ (zenith N. of the moon); the index correction was $-2' 10''$, height of the eye above the sea was 19 feet: required the latitude.

8. Aug. 29, 1836, at 10^h A.M. mean time nearly, in longitude $42^{\circ} 10' W.$, the observed meridian altitude of the planet Jupiter was $50^{\circ} 25' 10''$ (zenith N. of planet); the index correction was $-1' 50''$, and the height of the eye above the sea was 20 feet: required the latitude.

9. Sept. 19, 1836, the observed meridian altitude of α Urs. Maj., under the North Pole, was $2^{\circ} 25' 40''$; the index correction was $+4' 50''$, and the height of the eye above the sea was 18 feet: required the latitude.

10. Sept. 20, 1836, at 2^h 50^m A.M. mean time nearly, in longitude $72^{\circ} 10' W.$, the observed altitude of α Urs. Min. (Polaris) was $49^{\circ} 50' 10''$; the index correction was $+4' 50''$, and the height of the eye above the sea was 12 feet: required the latitude.

11. Sept. 15, 1836, observed the following double altitude of the sun.

Mean T. nearly.	Chronometer.	2 Obs. Alt. Sun's L.L.*	Tr. Bearing.
9 ^h 59 ^m A.M.	9 ^h 53 ^m 51 ^s	73° 12' 30"	S.E. b. S.
11 52 A.M.	11 46 32	84 24 10	S. $\frac{1}{2}$ E.

The run of the ship in the interval was 0. The height of the eye was 0. The index correction was $-36' 10''$. Required the true latitude at the second observation; the latitude by account being 52° N., and longitude 2° W.

12. Sept. 24, 1836, at 8^h 40^m A.M. mean time nearly, in latitude $48^{\circ} 48'$ N., and longitude by account $18^{\circ} 30'$ W., a chronometer showed 9^h 33^m 12^s, and the observed altitude of the sun's L.L. was $23^{\circ} 43' 50''$; the index correction was $-3' 15''$, and the height of the eye above the sea was 12 feet: required the true longitude.

Sept. 10, 1836, at Gr. mean noon, the chronometer was *slow* on Greenwich mean time $42^m 50^s$, and its daily rate was $2^s.6$ *losing*.

13. Sept. 3, 1836, at 9^h 18^m A.M. mean time nearly, in latitude $50^{\circ} 48'$ N., and longitude by account 2° W., the following lunar observation was taken.

Obs. Alt. Sun's L.L.	Moon's L.L.	Obs. Dist. N.L.
34° 46' 0"	44° 41' 0"	85° 33' 20"
Index cor. +4 10	+4 5	+2 16

The height of the eye above the sea was 19 feet: required the true longitude.

14. May 18, 1836, at 5^h 25^m A.M. in latitude $51^{\circ} 5'$ N., and longitude $112^{\circ} 42'$ W., the sun rose by compass E. $6^{\circ} 40'$ S.: required the variation.

15. April 3, 1836, at 6^h 20^m P.M. in latitude 50° N., and longitude 170° E., the compass bearing of the sun was W. $16^{\circ} 20'$ N.; and the observed altitude of the sun's L.L. was $11^{\circ} 45' 10''$; the index correction was $-2' 10''$, and the height of the eye above the sea was 17 feet: required the variation.

16. Find the mean time of high water at A on Oct. 15, A.M. and P.M. Change Tide, 3^h 50^m P.M. app. time. Long. A, $78^{\circ} 1'$ W.

Elements for I, from Nautical Almanac, 1836, with Answers.

1. N. $22^{\circ} 53'$ E. $457'$.

2. West 222.5 .

3. N. b. E. $\frac{1}{2}$ E.

4. Corrected courses W. $\frac{3}{4}$ N. $16'$ Departure Course; N.W. $10'$. 3, S.E. $\frac{1}{2}$ S. 21.6 ; S.S.E. $21'.1$; N. b. W. $\frac{1}{4}$ W. $13'.9$; S. $\frac{1}{4}$ E. $16'.7$; N. $\frac{1}{2}$ E. $20'.5$; S.E. b. E. $\frac{3}{4}$ E. $20'$ Latitude in $46^{\circ} 52''$ N. Long. in $15^{\circ} 8'$ W.

5. R. A. of mean sun, Sept. 16, at Gr. mean noon, $11^h 41^m 51^s.02$. R. A. $61'$ Cygni, $20^h 59^m 35^s.9$; R. A. ζ Pegasi $22^h 33^m 19^s.7$. From $61'$ Cygni to ζ Pegasi inclusive.

6. Sun's decl. on Aug. 28, at Gr. mean noon, $9^{\circ} 37' 57''$ N.; on Aug. 29, $9^{\circ} 16' 37''$ N., semid. $15' 52''$. Latitude $55^{\circ} 48' 26''$ N.

7. Moon's decl. on Sept. 17, at 21^h Gr. mean time, $27^{\circ} 9' 27''$ S.; at 22^h , $27^{\circ} 11' 6''$ S.; moon's hor. semid. on Sept. 17, at Gr. mean midn. $16' 6''.6$; on Sept. 18, at Gr. mean noon $16' 8''.1$; cor. hor. par. $59' 7''.1$ and $59' 12''.8$. Latitude $39^{\circ} 37' 29''$ N.

8. Decl. of planet Jupiter on Aug. 29, at Gr. mean noon, $19^{\circ} 10' 37''$ N.: on Aug. 30, $19^{\circ} 7' 40''$ N.; hor. par. $1''.47$. Latitude $58^{\circ} 52' 22''$ N.

9. Decl. α Urs. Maj. $62^{\circ} 37' 59''$ N. Latitude $29^{\circ} 31' 40''$ N.

10. R. A. of mean sun, on Sept. 19, at Gr. mean noon, $11^h 53^m 40^s.7$. Latitude $48^{\circ} 27'$ N.

11. Sun's decl. on Sept. 14, at Gr. mean noon, $3^{\circ} 18' 35''$ N.; on Sept. 15, $2^{\circ} 55' 27''$ N. Semid. $15' 56''$. Latitude $50^{\circ} 47' 48''$ N.

12. Sun's decl. on Sept. 23, at Gr. mean noon, $0^{\circ} 11' 6''$ S.; on Sept. 24, $0^{\circ} 34' 31''$ S. cor. Eq. T. $7^m 44^s.8$ S. and $8^m 5^s.3$ S.; semid. $15' 58''$. Hour angle $20^{\circ} 34' 37''$ W. Longitude $20^{\circ} 1'$ W.

13. Sun's decl. on Sept. 2, at Gr. mean noon; $7^{\circ} 49' 50''$ N.; on Sept. 3, $7^{\circ} 27' 49''$ N.; cor. Eq. T. $0^m 32^s.8$ S. and $0^m 52^s.0$ S.; semid. $15' 53''$; moon's hor. semid. Sept. 2, at Gr. mean midn. $14' 51''.5$; on Sept. 3, at Gr. mean noon, $14' 49''.0$; corresponding hor. par. $54' 31''.5$ and $54' 22''.3$. True Dist. $85^{\circ} 39' 34''$; true dist. at XXI, $85^{\circ} 48' 36''$; at XXIV, $84^{\circ} 26' 50''$. Hour angle $21^{\circ} 15' 46''$ W. Longitude $1^{\circ} 14' 15''$ W.

14. Sun's decl. on May 18, at Gr. mean noon, $19^{\circ} 37' 24''$ N.; on May 19, $19^{\circ} 50' 21''$ N. Tr. bearing E. $32^{\circ} 20'$ N. Variation $39^{\circ} 0' 15''$ W.

15. Sun's decl. on April 2, at Gr. mean noon, $5^{\circ} 3' 7''$ N.; on April 3, $5^{\circ} 26' 5''$ N.; semid. $16' 0''$. Tr. bearing N. $95^{\circ} 49' 45''$ W. Variation $22^{\circ} 9' 45''$ W.

16. Moon's Gr. mer. passage on Oct. 15, $4^h 19^m$; Oct. 14, $3^h 18^m$; semid. $16' 11''$. Eq. Time 14^m A to mean time. High water $6^h 36^m$ A.M. and $7^h 7^m$ P.M.

* Observed by Artificial Horizon

K.

1. Required the course and distance from A to B. Lat. A $50^{\circ} 15' S.$ long. A $5^{\circ} 18' E.$; lat. B $45^{\circ} 10' S.$, long. B $8^{\circ} 29' E.$

2. Required the course and distance from A to B. Lat. A $39^{\circ} 17' S.$, long. A $83^{\circ} 12' E.$; lat. B $39^{\circ} 17' S.$, long. B $97^{\circ} 18' E.$

3. A ship bore from me E.N.E. $\frac{1}{4} E.$, and a current run in the intermediate space S.S.E. 4 miles an hour; how must I steer to fetch the ship, supposing I can pull in still water $5\frac{1}{2}$ miles an hour?

4. Oct. 23, 1836, at noon, a point of land in longitude $18^{\circ} 28' E.$ and latitude $34^{\circ} 28' S.$ bore by compass N.W., distant 10 miles (variation of compass $2\frac{1}{4} W.$); afterwards sailed as by the following log account; required the latitude and longitude in, on Oct. 24, at noon.

H.	K.	$\frac{1}{10^{th}}$	Course.	Wind.	Lee-way.	
1	5	4	N. b. E. $\frac{1}{2} E.$	N.W. $\frac{1}{2} W.$	$2\frac{1}{4}$	Variation $2\frac{1}{4} W.$
2	5	2				
3	5	8				
4	6	1				
5	6	5	S.S.W.	N.N.W.	$\frac{1}{4}$	
6	7	3	..	..	..
7	7	0				
8	7	2				
9	6	8	N.W. b. W.	S.E.	0	
10	6	5				
11	6	1				
12	5	8	S. b. W. $\frac{3}{4} W.$	S.E. $\frac{1}{4} E.$	$2\frac{1}{4}$	
						Remarks in H. M. S. Oct. 24, 1836.
1	6	0				A current set the ship the last 5 hours N.W. by compass 2 miles an hour.
2	6	5				
3	6	8				
4	6	4	N.N.E.	N.W.	2	
5	6	0				
6	6	5	..	..	..
7	6	8				
8	7	2	N.W.	E.	0	
9	7	6				
10	7	9				
11	8	1				
12	8	5				

5. At what time will the star α Aurigæ pass the meridian of Gibraltar on May 17, 1836, and how far N. or S. of the zenith?

6. May 18, 1836, in longitude $93^{\circ} 17' E.$, the observed meridian altitude of the sun's L. L. was $39^{\circ} 28' 52''$ (zenith N. of the sun); the index correction was $-3' 12''$, and the height of the eye above the sea was 16 feet: required the latitude.

7. Dec. 17, 1836, at $7^h 54^m$ P. M. mean time nearly, in longitude $100^{\circ} 10' W.$, the observed meridian altitude of the moon's L. L. was $56^{\circ} 29' 10''$ (zenith N. of the moon); the index correction was $+7' 38''$, and the height of the eye above the sea was 22 feet: required the latitude.

8. May 8, 1836, the observed meridian altitude of the star α Orionis was $49^{\circ} 37' 48'$ (zenith N. of the star); the index correction was $-3' 18''$, and the height of the eye above the sea was 20 feet: required the latitude.

9. May 4, 1836, the observed meridian altitude of the star α Argus, under the South

Pole, was $37^{\circ} 12' 17''$; the index correction was $-3' 41''$, and the height of the eye above the sea was 19 feet: required the latitude.

10. May 17, 1836, at $2^h 48^m$ A.M. mean time nearly, in longitude $99^{\circ} 17' E.$, the observed altitude of the star α Urs. Min. was $43^{\circ} 28' 39''$; the index correction was $-3' 14''$, and the height of the eye above the sea was 12 feet: required the latitude.

11. March 14, 1836, the following double altitude of the sun was observed:—

Mean T. nearly.	Chronometer.	Obs. Alt. Sun's L.L.	Tr. Bearing.
$1^h 5^m$ P.M.	$8^h 2^m 25^s$	$41^{\circ} 20' 45''$	S.S.W. $\frac{1}{2}$ W.
5 6 P.M.	0 3 30	7 29 30	W. b. S. $\frac{1}{2}$ S.

The run of the ship in the interval was N.E. 18 miles; the index correction was $-3' 20''$, and the height of the eye above the sea was 23 feet: required the true latitude at the second observation; the latitude by account being $45^{\circ} N.$, and longitude $50^{\circ} 20' W.$

12. May 14, 1836, at $9^h 30^m$ A.M. mean time nearly, in latitude $50^{\circ} 48' N.$, and longitude by account 0° , a chronometer showed $9^h 26^m 18^s$, and the observed altitude of the sun's L. L. was $46^{\circ} 48' 7''$; the index correction was $+3' 10''$, and the height of the eye above the sea was 10 feet: required the true longitude.

On May 1, 1836, at Gr. mean noon, the chronometer was *slow* on Greenwich mean time $4^m 2^s$, and its daily rate was $3^s.5$ *losing*.

13. Jan. 20, 1836, at $3^h 0^m$ P.M. mean time nearly, in latitude $50^{\circ} 50' N.$, and longitude by account $22^{\circ} 10' E.$, the following lunar observation was taken.

Obs. Alt. Sun's L.L.	Moon's L.L.	Obs. Dist. N.L.
$8^{\circ} 32' 20''$	$20^{\circ} 41' 30''$	$29^{\circ} 12' 35''$
Index cor. 1 10 +	1 50 +	0 40 +

The height of the eye above the sea was 12 feet: required the longitude.

14. May 20, 1836, at $4^h 47^m$ A.M. mean time nearly, in latitude $18^{\circ} 42' S.$, and longitude $160^{\circ} E.$, the sun rose by compass $E. 21^{\circ} 18' 30'' N.$: required the variation.

15. March 7, 1836, at $2^h 50^m$ P. M. mean time nearly, in latitude $51^{\circ} 10' N.$, and longitude $86^{\circ} E.$, the compass bearing of the sun was $S. 74^{\circ} 42' W.$; and at the same time the observed altitude of the sun's L. L. was $21^{\circ} 40' 45''$; the index correction was $-2' 18''$, and the height of the eye above the sea was 14 feet: required the variation.

16. Required the time of high water at A on August 17, 1836, A.M. and P.M. Change Tide at A, $5^h 18^m$ A.M. app. time. Long. A, $93^{\circ} E.$

Elements for K, from Nautical Almanac 1836, with Answers.

1. N. $22^{\circ} 49' E.$ $330'.9$.
2. East $654'.8$.
3. N. N. E.
4. Corrected courses E. S. E. $\frac{1}{4} E.$ $10'$ Dep. Course; N. b. E. $\frac{1}{2} E.$ $22'.5$; S $\frac{1}{2} E.$ $28'$; W. $\frac{3}{4} N.$ $19'.4$; S. b. W. $\frac{3}{4} W.$ $25'.1$; N. b. E. $\frac{3}{4} E.$ $25'.7$; W. b. N. $\frac{3}{4} N.$ $49'.3$. Latitude in $34^{\circ} 17' 54'' S.$ Longitude in $17^{\circ} 32' E.$
5. R. A. of mean sun, May 17, at Gr. mean noon, $3^h 40^m 51^s.11$. R. A. α Aurigæ $5^h 4^m 33^s.5$, decl. $45^{\circ} 49' 30'' N.$ At $1^h 23^m 26^s$; N. of zenith $9^{\circ} 42' 30''$.
6. Sun's decl. on May 17, at Gr. mean noon, $19^{\circ} 24' 8'' N.$; on May 18, $19^{\circ} 37' 24'' N.$; semid. $15' 50''$. Latitude $69^{\circ} 57' 26'' N.$
7. Moon's decl. on Dec. 17, at 14^h mean time, $11^{\circ} 11' 15'' N.$; at 15^h , $11^{\circ} 24' 45'' N.$; moon's hor. semid. on Dec. 17, at Gr. mean midn. $15' 14''.2$; on Dec. 18, $15' 9''.7$; cor. hor. par. $55' 54''.9$ and $55' 38''.2$. Latitude $44^{\circ} 1' 33'' N.$
8. Star's decl. $7^{\circ} 22' 15'' N.$ Latitude $47^{\circ} 52' 58'' N.$
9. Star's decl. $52^{\circ} 36' 41'' S.$ Latitude $74^{\circ} 26' 22'' S.$
10. R. A. of mean sun, on May 16, at Gr. mean noon, $3^h 36^m 54^s.54$. Latitude $43^{\circ} 35' N.$
11. Sun's decl. on March 14, at Gr. mean noon, $2^{\circ} 23' 53'' S.$; on March 15, $2^{\circ} 0' 12'' S.$ Semid. $16' 6''$. Arc (1) $60^{\circ} 13'$, (2) $91^{\circ} 23' 15''$, (3) $46^{\circ} 23' 45''$. Latitude $44^{\circ} 3' 38'' N.$
12. Sun's decl. on May 13, at Gr. mean noon, $18^{\circ} 27' 47'' N.$; on May 14, $18^{\circ} 42' 21' N.$; corresponding Eq. T. $3^m 56^s.0$ S. and $3^m 56^s.3$ S.; hour angle $21^h 35^m 35^s$ W. Longitude $0^{\circ} 8' 30'' E.$
13. Sun's decl. on Jan. 20, at Gr. mean noon, $20^{\circ} 16' 3'' S.$; on Jan. 21.

Example continued

$20^{\circ} 3' 5''$ S. corr. Eq. T. $11^m 10^s.9$ A, and $11^m 28^s.7$ A; sun's semid. $16' 16''$; moon's hor. semid. on Jan. 20, at Gr. mean noon, $16' 1' .3$; on Jan. 20, at Gr. mean midn. $15' 54'' .1$; corresponding hor. par. $58' 47'' .7$ and $58' 21'' .3$. True dist. $30^{\circ} 6' 54''$; dist. at mean noon $29^{\circ} 17' 10''$, at III. $30^{\circ} 53' 17''$. Hour angle $2^h 59^m 54^s$ W. Longitude $24^{\circ} 29' E$.

14. Sun's decl. on May 19, at Gr. mean noon, $19^{\circ} 50' 21'' N.$; on May 20, $20^{\circ} 2' 57'' N.$ Tr. bearing E. $21^{\circ} 3' 0'' N.$ Variation $0^{\circ} 15' 30'' E$.

15. Sun's decl. on March 6, at Gr. mean noon, $5^{\circ} 31' 55'' S.$; on March 7, $5^{\circ} 8' 36'' S.$; semid. $16' 8''$. Tr. bearing N. $130^{\circ} 44' 0'' W.$ Variation $25^{\circ} 26' 0'' W$.

16. Moon's Gr. mer. passage on Aug. 17, $3^h 55^m$, Aug. 16, $3^h 10^m$; semid. $15' 38''$ Eq. time $4^m S.$ from mean time. High water $7^h 39^m$ A. M., and $8^h 1^m$ P. M.

APPENDIX.

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APPENDIX.

(1.) In fig. p. 2 of Navigation, AB, BC, CD, &c., which cut the meridians PA, PB, PC, &c., at equal angles, are supposed to be evanescent increments of the ship's track on the sea considered as a spherical surface. Let the equator UZ be supposed to become a straight line on a plane surface, into which the spherical surface OUZF has been forced; and at the same time UA, VB, WC, &c., to become straight lines perpendicular to UZ so straightened, and consequently to be parallel to each other. In effecting this change, HB, IC, KD, &c. must be supposed also to be made straight, and (since UA, VB, WC, &c., are now considered parallel straight lines) to be lengthened so as to be equal respectively to UV, VW, WX, &c. To preserve the similarity of the triangles AHB, BIC, CKD, &c., as on the sphere, the increments of latitude AH, BI, CK, &c., must be supposed to be lengthened in the same proportion as HB, IC, KD, &c.; in which case the angles A, B, C, &c., on the plane surface, would be equal to A, B, C, &c., on the sphere, and therefore equal to each other. And, consequently, the line corresponding to AF would be a straight line cutting the parallel straight lines into which the meridians UA, VB, WC, &c., have been forced, at an angle equal to the course HAB on the sphere.

The plane figure thus constructed, commencing at the equator, all the points on it being marked in latitude and longitude, as the corresponding points on the sphere are marked, is called a *Mercator's Chart*, the principal use of which is as follows. To find the *course* from any point A to another point F on the sphere, it is only necessary to measure the angle, which a straight line drawn from A to F on the *chart* makes with any one of the straight lines corresponding to meridians. This angle is the *true course* to be steered on the sphere, that is, the angle which AF makes on the sphere with the meridians PA, PB, &c.

In order actually to construct such a *chart*, it is necessary to determine the numerical value of the latitude of any point on it in minutes of a meridian on the sphere; that is, supposing a minute of latitude on the sphere to be (for instance) one inch in length, it is necessary to find the distance in inches of any point on the chart from the base line representing the equator. Now since UV and HB are considered corresponding evanescent parts of the equator and a parallel of latitude, they must have the same proportion to each other as the whole equator has to the whole parallel of latitude, or as the radius of the equator has to the radius of the parallel. But the radius of the parallel is a straight line drawn from B perpendicular to the axis of the sphere, that is, to the diameter of the meridian PBV passing through P; which perpendicular is the *sine* of the arc PB, or *sine* of the colatitude of B, supposing the radius of the sphere to be 1. Now the proportion of the corresponding increments of latitude on the chart and of latitude on the sphere has been shown to be that of UV to HB, that is, of 1 : *sine* of the colatitude of B. Wherefore, if *c* denote the colatitude PB, we have (using the differential notation)—

$$d \text{ lat. on chart} : d \text{ lat. on sphere} :: 1 : \sin. c; \text{ consequently,}$$

$$d \text{ lat. on chart} = \frac{d \text{ lat. on sphere}}{\sin. c} = \frac{-dc}{\sin. c} = \frac{-dc}{2 \sin. \frac{1}{2} c \cos. \frac{1}{2} c} = \frac{-\frac{1}{2} dc}{\sin. \frac{1}{2} c} \cdot \frac{\sin. \frac{1}{2} c}{\cos. \frac{1}{2} c}.$$

That is, $d \text{ lat. on chart} = \frac{d \cot. \frac{1}{2} c}{\cot. \frac{1}{2} c}$, and integrating, $\text{lat. on chart} = \text{nap. log. cot. } \frac{1}{2} c$; which integral requires no correction, since, when $\text{lat.} = 0$, $\frac{1}{2} \text{ colat.}$ or $\frac{1}{2} c = 45^\circ$, and $\cot. 45^\circ = 1$, whose log. = 0.

We have here the value of the latitude on chart in *naperian logarithms*: to get it in *common logarithms*, we must multiply by 2.302585, &c., and if the $\log. \cot. \frac{1}{2} c$ be taken from the common *tabular log. cotangents*, we must subtract 10 from the index. So that in common logarithms, $\text{lat. on chart} = (\log. \cot. \frac{1}{2} \text{ colat.} - 10) \times 2.302585$, &c., this being expressed in terms of radius 1. To express it in terms of minutes of the meridian, or minutes of longitude on chart, we must multiply by the length of the radius in minutes, that is, by 3437.74677... &c. Hence—

$\text{lat. on chart in minutes} = (\log. \cot. \frac{1}{2} \text{ colat.} - 10) \times 2.302585 \dots \times 3437.74677$, &c.
 And, $\log. \text{lat. on chart} = \log. (\log. \cot. \frac{1}{2} \text{ colat.} - 10) + 3.898498 \dots$

Ex. Let lat. on sphere be 49° ; $\frac{1}{2}$ colat. = $20^\circ 30'$; $\log. \cot. - 10 = 0.427262$; $\log. 0.427262 \dots = *9.630694$. Consequently, $\log. \text{lat. on chart} = 9.630694 + 3.898498 - 10 = 3.529192$: and lat. on chart = 3382.1 minutes.

(2.) A numerical proportion thus expressed $a : b :: c : d$ may be also expressed thus, $\frac{a}{b} = \frac{c}{d}$. By multiplying each side of this equation by bd , we have $ad = bc$. Consequently $\log. a + \log. d = \log. b + \log. c$. Whence by transposing:

$$\begin{aligned} \log. a &= \log. b + \log. c - \log. d. & \log. c &= \log. a + \log. d - \log. b. \\ \log. b &= \log. a + \log. d - \log. c. & \log. d &= \log. b + \log. c - \log. a. \end{aligned}$$

From which four equations the rule in Art. 12 of Navigation is proved.

(3.) Let a tube of water be supposed to reach from the earth's centre to a point in its equator, and another tube of water from the earth's centre to the pole, the two tubes communicating with each other at the centre. Then, if the earth were an exact sphere and at rest, the two tubes of water, by their equal gravitation to the earth's centre, would balance each other. But if the earth were made to revolve, as it really does, round the polar axis or latter supposed tube, in that case the particles of water in the equatorial tube, by their rotation, would acquire a tendency to fly off or recede from the centre, that is, they would lose part of their gravitation to the centre; while those in the polar tube having no rotation would lose no part whatever of their gravitation. The equilibrium therefore of the two tubes would be disturbed. The polar tube would be the heavier, and would consequently sink down and force out the equatorial one; that is, the former would be shortened and the latter lengthened. From considerations of this kind, combined with the received theory of gravity, Newton determined the proportion of the equatorial radius of the earth to the polar one to be 230 : 229. This conclusion, however, supposes the matter of which the earth is composed to be of an uniform density and to have the consistency of water.

If we were to suppose a tube of water to reach from the earth's centre to a point on its surface between the pole and the equator, the particles in such a tube would also lose part of their gravitation to the centre by a supposed rotation round the polar tube, but less than those in the equatorial tube, and less and less as the point on the surface approached the pole. From this consideration it appears that the radii of the earth are less and less in length from the equator to the pole. On physical principles it has been proved that the curve perpendicular to the equator, and extending thereto from the pole, is an ellipse, having the equatorial diameter for its greater axis, and the polar diameter for its less axis. The earth is hence called an *ellipsoid*.

Since the earth thus appears to be less and less curved in leaving the equator and approaching the pole, it follows that a degree of latitude, in such a case, ought to take a greater and greater space of a meridian. And actual measurement confirms this conclusion. By a series of triangular measurements the length of an arc corresponding to a certain change in latitude has been ascertained in different countries, the said change in latitude being determined by astronomical observation. Hence the length of 1° has been deduced, together with the latitude of the middle point thereof.† From these the length of the equatorial radius and that of the polar radius have been computed, and thus the earth has been proved to be actually of that spheroidal form which the theory of gravitation suggests. Taking the measurements best adapted to the purpose, the equatorial radius

* See Note to App., p. 241 and 248.

† Country.	Lat. of Middle Point.	Arc measured.	Length of 1° in Feet.	Observers.
Sweden . . .	$66^\circ 20' 10''$	$1^\circ 37' 19''$	365782	Svanberg.
Russia . . .	58 17 37	3 35 5	365368	Struve.
England . . .	52 35 45	3 57 13	364971	Roy, Kater.
France . . .	46 52 2	8 20 0	364872	Lacaille, Cassini.
" . . .	41 51 2	12 22 13	364535	Delambre, Mechain.
Rome . . .	42 59 0	2 9 47	364262	Boscovich.
America, U. S. .	39 12 0	1 28 45	363786	Mason, Dixon.
Cape of Good Hope	33 18 30	1 13 $17\frac{1}{2}$	364713	Lacaille.
India . . .	16 8 22	15 57 40	363044	Lambton, Everest.
" . . .	12 32 21	1 34 56	363013	Lambton.
Peru . . .	1 31 0	3 7 3	362808	Condamine, &c.

has been thus found to be about 3962·35 statute miles, and the polar radius about 12·68 miles less than this, that is, about 3949·67 miles. The fractional part, which the difference is of the greatest radius, is taken as a measure of the compression of the earth at the poles, and is called in one word the *compression*. Taking the results just stated,

the *compression* appears to be $\frac{12.68}{3962.35}$ or $\frac{1}{312.5}$. The proper formulæ for making these computations will be given below, and also an example of their application.

The results from measurements of degrees in different countries have been found considerably to vary from each other, indicating therefore considerable deviations of the figure of the earth from that of an exact spheroid. At the same time the compression got from the measurement of degrees of latitude is much less than $\frac{1}{312}$, which Newton deduced from the theory of gravitation on the supposition of a uniform density of matter from the surface of the earth to the centre. This seems decidedly to prove that such a supposition cannot be agreeable to fact; that on the contrary the density increases towards the central parts of the earth.

Let a = equatorial radius of the earth; b = polar radius; D = feet in a degree of meridian, whose middle point is in latitude L ; d = feet in a degree, whose middle point is in latitude l less than L . Then,

$$\text{If } \text{Log. } N = 7.558367 + \log. \text{ cosec. } (L + l) - 10 + \log. \text{ cosec. } (L - l) - 10 \quad (1)$$

$$\text{We have, } \text{Log. } a \text{ in stat. miles} = \log. \{ 3 (d \sin.^2 L - D \sin.^2 l) + 2 (D - d) \} + \log. N - 10 \quad (2)$$

$$\text{And } \text{Log. } (a - b) = \log. N + \log. (D - d) - 10 \quad (3)$$

$$\text{Ex. Let } D = 365368 \text{ feet as measured in Russia; } L = 58^{\circ} 17' 37'' \\ d = 363013 \text{ feet as measured in India; } l = 12^{\circ} 32' 21''$$

$$\begin{array}{rcl} D - d & = & 2355 \\ 2 (D - d) & = & 4710 \end{array} \qquad \begin{array}{rcl} L + l & = & 70 \quad 49 \quad 58 \\ L - l & = & 45 \quad 45 \quad 16 \end{array}$$

$$\text{From (1) } \text{Log. } N = 7.558367 + 0.024767 + 0.144873 = 7.728007$$

$$(2) \dots \text{Log. } d \sin.^2 L = \log. d + 2 \log. \sin. L - 20 = 5.419529; \text{ nat. nbr.} = 262743.14$$

$$(2) \dots \text{Log. } D \sin.^2 l = \log. D + 2 \log. \sin. l - 20 = 4.236078; \text{ nat. nbr.} = 17221.78$$

$$\text{Diff. } \times 3 = 736564.08 \quad \text{Diff.} = 245521.36$$

$$2 (D - d) = 4710$$

$$\text{Sum} = 741274.08 \quad \log. = 5.869978$$

$$\log. N = 7.728007$$

$$a = 3962.65 \text{ miles} \quad \log. a = 3.597985$$

$$(3) \dots \text{Log. } (a - b) = 7.728007 + 3.371991 - 10 = 1.099998 \dots a - b = 12.58 \text{ miles.}$$

From this example, which seems to be one of the most likely to give a correct result, it appears that the equatorial radius is 3962·65, the polar radius 3950·07, and the compression $\frac{1}{315}$ nearly.

The compression may be also found by observing the oscillations of a pendulum of invariable length in different latitudes, or those of pendulums of different lengths. The number of oscillations made by the former in a given interval of time is noted at both latitudes, and the latter are supposed to make an equal number of vibrations in a given interval in both latitudes. The effect of gravitation on a particle of matter on the earth's surface is less the nearer it is to the equator, on account both of the greater effect of diurnal motion in diminishing gravitation, and also of the greater distance of the particle from the earth's centre. A pendulum, therefore, of invariable length must vibrate the more slowly the nearer it is taken to the equator; and it will require a shorter pendulum near the equator to vibrate in the same time with one farther from it. The following formulæ and example will sufficiently explain the required computations.

Supposing gravitation at equator to be denoted by 1, let the increase of gravitation from equator to pole be g . Let the number of vibrations in a given time, as 24 sidereal

hours, at latitude $l = N$; and let the *additional* number by the same pendulum in the same interval at latitude L greater than $l = n$.

$$\text{Then, } g = \frac{2n}{N} \text{ cosec. } (L + l) \text{ cosec. } (L - l) + g^2 \sin^2 l.$$

Supposing the last term $g^2 \sin^2 l$ to be inconsiderable:

$$\text{Log. } g = \log. 2n + \text{ar. co. log. } N. + \log. \text{ cosec. } (L + l) + \log. \text{ cosec. } (L - l) - 30.$$

$$\text{And compression} = .00865052 - g.$$

In latitude 5° a pendulum oscillated sidereal seconds, that is 86,400 seconds in 24 sidereal hours: in latitude 50° it gained 135.8 seconds in the same interval. Required the difference of gravitation at equator and pole, and the compression of the earth.

$$\text{Here } 2n = 271.6; N = 86,400; L + l = 55^\circ; L - l = 45^\circ.$$

$$\text{Log. } 2n = 2.433930; \text{ar. co. log. } N = 5.063486; \log. \text{ cosec. } (L + l) = 10.086636; \log. \text{ cosec. } (L - l) = 10.150515. \text{ The sum of these numbers} - 20^* = 7.734567; \text{nat. number} = .00542709. \text{ That is, } g = .00542709.$$

$$\text{Hence, compression} = .00865052 - .00542709 = .00323343 = \frac{1}{310.2}.$$

This is nearly the mean result of different observations made with the pendulum. It must be noticed that $g^2 \sin^2 l$ has been neglected, which in this example is .0000002; it can never be greater than .00003.

When the lengths of two pendulums are known, both of which vibrate in the same time, that is, make the same number of oscillations in a given interval, as a sidereal day: let P = longer pendulum, L = corresponding greater latitude; p = shorter pendulum, l = corresponding less latitude. Then:

$$g = \frac{P - p}{p \sin^2 L - P \sin^2 l} \dots (1); \text{ and compression} = .00865052 - g \dots (2).$$

$$\text{Ex. Let } P = 39 \text{ inches, } p = 38.877 \text{ inches, } L = 50^\circ, l = 4^\circ; P - p = 0.123$$

$$(1) \dots \text{Log. } p \sin^2 L = \log. p + 2 \log. \sin. L - 20 = 1.358201; \text{nat. nbr.} = 22.814$$

$$(1) \dots \text{Log. } P \sin^2 l = \log. P + 2 \log. \sin. l - 20 = 9.278233; \text{nat. nbr.} = 0.18977$$

$$\text{Diff.} = 22.62423$$

$$\text{Hence } g = \frac{.123}{22.62423} = .00543223; \text{ and compression} = .00865052 - .00543223$$

$$= .00321829 = \frac{1}{310.7}.$$

Again, the compression has been deduced also from a comparison of inequalities in the moon's motion, determined by observation, with the same inequalities computed from the theory of gravitation, being known to arise from the attraction of the protuberant matter near the earth's equator. The compression has been thus found to be about $\frac{1}{305}$.

(4.) Given the true Latitude, to find the reduced Latitude.

Let L = the true latitude, that is, the angle made with the plane of the earth's equator by a perpendicular to the earth's surface at the place of the observer. Let l = the reduced latitude, that is, the angle made with the same plane by the earth's radius at the said place. Let a = equatorial radius of the earth, b = polar radius. Then $b^2 : a^2 :: \tan. L : \tan. l$,

or $\tan. l = \frac{b^2}{a^2} \tan. L$: whence we have the following rule, the table subjoined containing

the value of $\log. \frac{b^2}{a^2} + 10$ for different compressions of the earth.

RULE.—To logarithm in the table corresponding to supposed compression, add $\log. \tan.$ of true latitude, rejecting 10 from the index of sum. The result will be the $\log. \tan.$ of reduced latitude.

* When number to be rejected from resulting index, as 10, 20, &c., is greater than such index; in that case a number less by 10 is rejected; and in corresponding *nat. number* the first significant figure is as many places to the right of unit's places as the index left is less than 10.

Ex. The true latitude is 60° ; required the reduced latitude for compression $\frac{1}{317}$

Tab. logarithm . . . 9.997256

Log. *tan.* 60° . . . 10.238561

Log. *tan.* red. lat. 10.235817

Hence red. lat. = $59^\circ 50' 35''$ and
the reduction = $9' 25''$ (see Naut. Tab. p. 4).

Compression.	Logarithm.	Compression.	Logarithm.	Compression.	Logarithm.
$\frac{1}{295}$	9.997061	$\frac{1}{305}$	9.997157	$\frac{1}{315}$	9.997247
$\frac{1}{298}$	9.997080	$\frac{1}{308}$	9.997175	$\frac{1}{318}$	9.997264
$\frac{1}{300}$	9.997100	$\frac{1}{310}$	9.997193	$\frac{1}{320}$	9.997281
$\frac{1}{302}$	9.997119	$\frac{1}{312}$	9.997212	$\frac{1}{322}$	9.997298
$\frac{1}{304}$	9.997138	$\frac{1}{314}$	9.997229	$\frac{1}{324}$	9.997315

(5.) *To find the Reduction of Equatorial Parallax for a given Latitude.*

If $\frac{1}{c}$ = the earth's compression, and l = latitude, the radius of the earth at the lati-

tude l is to the equatorial radius as $1 - \frac{1}{c} \sin^2 l$ to 1. Consequently, if H denote the equatorial horizontal parallax, that is, the angle subtended at a heavenly body by the equatorial radius of the earth, when a straight line drawn to the body is perpendicular to that radius; and H' denote the angle similarly subtended by the earth's radius at the given latitude, or the horizontal parallax there, it is evident that $H' : H :: 1 - \frac{1}{c} \sin^2 l : 1$,

whence $H - H' = H \cdot \frac{1}{c} \sin^2 l = H \cdot \frac{1}{c} \text{hav. } 2l$; and $\frac{3^h}{H - H'} = \frac{3^h}{H} \cdot c \cdot \frac{1}{\text{hav. } 2l}$.
In logarithms therefore, prop. log. $(H - H') = \text{prop. log. } H + \log. c. + \text{ar. co. log. hav. } 2l$,
whence the following rule:—

RULE.—Add together ar. co. log. *hav.* of twice the latitude, *log.* of denominator of compression, and *prop. log.* of hor. parallax, as given in the Nautical Almanac (taken to the nearest whole second). The sum will be the *prop. log.* of reduction required, which take to the nearest *tenth* of second from Naut. Tables (qq.) p. 16, and subtract it from the given equatorial hor. parallax, *taking in* the tenths of seconds rejected before.

Ex. Supposing the compression = $\frac{1}{317}$ and the equatorial hor. parallax = $60' 2'' \cdot 3$:
required the *reduced* hor. parallax in latitude 60° .

Ar. co. log. *hav.* 120° . . . 0.124939

Log. of $\frac{1}{317}$. . . 2.501059

Prog. log. $60' 2''$. . . 0.476880

Prop. log. . . . 3.102578

Reduction $0' 8'' \cdot 5$

Hor. Eq. Par. $60 2 \cdot 3$

Red. Hor. Par. $59 53 \cdot 8$

(6.) The investigation of atmospherical refraction is attended with considerable difficulty; so that tables containing the amount of such refraction for different altitudes of a heavenly body, constructed by different persons, do not exactly agree with each other, especially when the altitudes are small. The whole refraction or deviation of direction which a ray of light undergoes in passing through the atmosphere from the top thereof, as from D (see fig. p. 54 of Naut. Astron.) to the spectator's eye at A , may be proved, on physical principles, to be proportional to the angle ACD at the earth's centre, between the extreme radii CA and CD ; that is, if r denote the refraction in seconds, and C denote the said angle at C in seconds, $\frac{C}{r}$ is a constant number. It may be proved also, if z denote the apparent zenith distance of the heavenly body to an observer at A , and I denote the

angle of incidence * of a ray at D, that $z - I$ (supposed also in seconds) = $C - r$; or that $\frac{z - I}{r} = \frac{C - r}{r}$ and is a constant number.†

Let it now be supposed that the ray enters a lamina of air at D, similar in every respect to the air at A; in which case it would undergo at once a refraction or deviation of direction at D, not differing very much from the actual refraction it undergoes in passing from D through the atmosphere as naturally constituted. Provided the successive laminae E, F, &c., were parallel, at the points where the ray enters them, to the highest lamina at D; in that case the single refraction at D, on the supposition just made, would be exactly equal, on well known optical principles, to the amount of refraction through the natural atmosphere from D to A; that is, the refracted ray at D would be parallel to the refracted ray as it enters the eye at A. What it differs therefrom must therefore be owing to the excesses of the real angles of incidence, at E, F, &c., arising from the convexity of the surfaces there, over the imagined angles of incidence on the supposition of parallel surfaces. The natural refractions, on account of these excesses, must be something greater than if the surfaces were parallel, that is, something greater than the single refraction at D in air similar to the air at A; and the more so the more obliquely the ray passes through the laminae. It hence appears, that one great difficulty in finding the amount of refraction consists in discovering in what way proper allowances may be made for the effect of the spherical excesses just mentioned.

One mode of proceeding may perhaps be as follows. Let the angle of incidence at D, denoted by I, be supposed to be increased, so that a ray, when refracted at D by air similar to that at A, may be actually parallel to the refracted ray after passing through the natural atmosphere to the eye from an angle of incidence I *unaltered*. Such increase of I must evidently bear some relation to the amount of the refraction r , since the deviations of the refracting surfaces from parallelism increase constantly, as a ray approaches a horizontal direction, that is, as r increases. So that, although $z - I$ cannot be proportional

* The angle which a ray incident on any surface makes with the perpendicular to that surface at the point of incidence, is called the *angle of incidence*, denoted usually by I; and the angle which the ray makes with the same perpendicular produced, after passing the said surface, is called the *angle of refraction*, denoted usually by R, supposing the ray to be bent or refracted in entering.

† Let DA (fig. p. 54 of Naut. Astron.) be considered as a *differential* of the curve described by a particle of light as it passes through the atmosphere to the spectator's eye; DTS, AT, tangents thereto at D and A, meeting each other at T. Let AS be parallel to CD, C being the earth's centre. Let v = velocity of the particle at D, supposed to be a point within the atmosphere on a lamina D. Let t = time from the top of the atmosphere; f = attracting force on particle from increase of air's density, which force tends to the earth's centre C, being perpendicular to lamina D. Then acute angle at S = angle CDS = angle of incidence at D = I; acute angle at T = deviation or refraction of light in passing through DA = *differential* of r , or $d r$, and angle C = *d whole central angle*.

Now, $\frac{\sin. C}{\sin. D \text{ or } \sin. I} = \frac{D A}{C A}$, and $\frac{\sin. S \text{ or } \sin. I}{\sin. T} = \frac{A T}{A S} = \frac{\frac{1}{2} D A}{A S}$; multiplying $\frac{\sin. C}{\sin. T} = \frac{D A^2}{2 A S. C A} = \frac{v^2 d t^2}{f d t^2. C A} = \frac{v^2}{f. C A}$. That is, $\frac{d \text{ central angle}}{d r} = \frac{v^2}{f. C A}$. Now, since light enters the top of the atmosphere everywhere with the same velocity, and is there first attracted towards the earth's centre; and since the attractions on it afterwards at all equal distances therefrom, that is, at every point of each successive lamina, are supposed equal,† it follows that v must be the same for every such point (Newton's Principia, Prop. xl.). Again, at such points f and $C A$ are the same; consequently $\frac{d \text{ central angle}}{d r}$ must be the same. But central angle and r begin and end together;

wherefore $\frac{\text{central angle}}{r}$ is constant, and $\frac{\text{central angle}}{r} - 1$ or $\frac{\text{central angle} - r}{r}$ is constant. Let now DA represent the whole radial curve. Then ZAT = app. zen. dist. = z ; and ZAT - ZAS = SAT = $S - T$, or $z - C = I - r$, or $z - I = C - r$; consequently $\frac{z - I}{r} = \frac{C - r}{r}$ and is constant.

† Near the horizon the change of the air's density is affected by causes not in operation at the spectator's place. This supposition may not there be always true.

(when I is increased) to r , yet it may be supposed to be proportional to r^a , a being some constant number less than 1; that is, $\frac{z-I}{r^a} = b$, or $z-I = br^a$, I being increased as above. The actual values of a and b may be deduced from the refractions determined by two observations at proper distances from each other in respect to the altitude of a heavenly body, as follows:—

The refraction at the app. zen. distance of 45° was determined by Brinkley to be $58''\cdot338$; that at $z = 82^\circ 40'$ was determined by Bradley to be $427''\cdot38$; the results of observation being reduced to barometer 30 and Fahr. thermometer 50 (see Naut. Almanac for 1827). We get (see note*) $z - I = 309''\cdot075$ for the former, and $1459''\cdot59$ for the latter. Hence therefore $309\cdot075 : 1459''\cdot59 :: 58\cdot338^a : 427\cdot38^a$; whence a is found to be very nearly $\frac{1}{1\cdot2828}$. Again, since $b = \frac{z-I}{r^a}$ we have $b = 309\cdot075 \div 58\cdot338^a$ or

$1459\cdot59 \div 427\cdot38^a$. Substituting for a its value $\frac{1}{1\cdot2828}$, we get $\log. b = 1\cdot11338$ very

nearly. With these values of a and $\log. b$, we may determine that of $z - I$, supposing r to be known. Now from experiment $\log. \sin. R. = \log. \sin. I - \cdot00012324$. Assuming, therefore, any arc for I , the value of R is easily computed, and consequently $I - R$ or r is known. Computing then $z - I$ corresponding to r , and adding the result to the assumed arc I , we get z , or the app. zen. distance corresponding to the refraction r . The rule is as follows:—

RULE.—Assuming the value of I , take from the Tables (which for this part of the operation should be given to seven places) the $\log. \sin. I$, and subtract therefrom $0\cdot00012324$: the remainder will be the $\log. \sin. R$. Take R from the Tables to nearest hundredth of second, and subtract it from I ; the remainder will be the refraction corresponding to I , which bring into seconds; take out the logarithm thereof, and divide it by $1\cdot2828$ (see subjoined Table). To the quotient continued to five places of decimals add $1\cdot11338$; the sum will be the $\log.$ of $z - I$ in seconds, which take from the Tables, and add in $^\circ \prime \prime$ to the assumed value of I . The sum will be the value of z , or the app. zen. dist. corresponding to the computed refraction.

The application of this rule will be made very easy by taking the products of 12828 and the numbers $1, 2, 3$, &c. from the subjoined Table.

Ex. Let $I = 84^\circ 28' 29''$, whose $\log. \sin. = 9\cdot9979775$; subtracting $0\cdot00012324$, we have $9\cdot99785426$, the $\log. \sin.$ of $84^\circ 18' 33''\cdot14$, which = R ; hence $I - R$ or refraction is $9' 55''\cdot86$ or $595''\cdot86$. Dividing $\log.$ of this by $1\cdot2828$, the quotient is $2\cdot16335$, to which adding $1\cdot11338$, the sum is $3\cdot27673$. The *nat. number* corresponding to this is $1891''\cdot2$ or $31' 31''\cdot2$, which, added to $84^\circ 28' 29''$, gives z or the app. zen. dist. = $85^\circ 0' 0''\cdot2$. The refraction therefore at $z = 85^\circ$ may be considered = $9' 55''\cdot9$ to the nearest tenth of second.

In this example the value of I has been correctly assumed, so as to give the refraction at $z = 85^\circ$. But, in general, it is necessary to guess its value, which may be done by observing its amount for a few app. zen. distances in the subjoined table. The result of the first assumption will generally enable the computer to take another value, such that from the two results he may find by proportioning the refraction at the proposed app. zen. distance.

The following table contains the refractions computed by the above rule for a few app. zen. distances, to which are added the corresponding refractions given in the tables constructed by Young and Ivory, which are considered as the most correct (See Phil. Trans. for 1819 and 1823). The proper values assumed for I in the computation are also given, and also the products of 12828 and $1, 2, 3$, &c. to facilitate the division by $1\cdot2828$.

* From experiment it appears that $\frac{\sin. I \text{ or } \sin. (R+r)}{\sin. R} = m + 1$, where $m = \cdot0002838$. Expanding $\sin. (R+r)$, dividing by $\sin. R$, cancelling 1 on each side, and putting $\cot. R$ for $\frac{\cos. R}{\sin. R}$, we have $r \cdot \cot. R - \frac{1}{2} r^2 - \frac{1}{6} r^3 \cot. R = m$, or $\cot. R = \frac{m + \frac{1}{2} r^2}{r - \frac{1}{6} r^3}$ (very nearly) $= \frac{m}{r} + \frac{1}{2} r =$ (if r be in seconds of arc) $\frac{m}{r \sin. 1''} + \frac{1}{2} r \sin. 1''$. From this expression, if r be known, R may be found. Adding to R the given refraction, the sum is the value of I ; and subtracting this from the known app. zen. distance z at the observation, the result is the value of $z - I$.

$z =$	15°	30°	45°	60°	65°	70°	75°	80°	85°	90°
By Rule	0 15 ¹¹ ·6	0 33 ¹¹ ·7	0 58 ¹¹ ·3	1 40 ¹¹ ·8	2 4 ¹¹ ·6	2 39 ¹¹ ·0	3 34 ¹¹ ·5	5 19 ¹¹ ·9	9 55 ¹¹ ·9	33 53 ¹¹
Young	0 15·5	0 33·6	0 58·1	1 40·5	2 4·2	2 38·7	3 34·3	5 20·0	9 58·0	33 51
Ivory	0 15·66	0 33·72	0 58·36	1 40·85	2 4·65	2 39·16	3 34·70	5 20·19	9 53·8	34 17·5
$I =$ nearly	0 15	0 30	0 44 54	0 59 52	0 64 50 40	0 69 49 0	0 74 45 48	0 79 40 20	0 84 28 29	0 87 38 0
12828 $\times d$ by	1	2	3	4	5	6	7	8	9	
=	12828	25656	38484	51312	64140	76968	89796	102624	115452	

Bar. 30. Ther. 50.—By observation Bradley makes $r = 7' 7'' \cdot 38$ at $z = 82^\circ 40'$. Rule, $7' 7'' \cdot 4$.
 Pond makes $r = 3' 55'' \cdot 49$ at $z = 76^\circ 20'$. Rule, $3' 55'' \cdot 5$. Brinkley makes $r = 58'' \cdot 338$ at $z = 45^\circ$.
 Rule, $58'' \cdot 3$.

In the above table of refractions the barometer is supposed to stand at 30 and Fahrenheit's thermometer at 50. These are considered as average heights at the level of the sea; and the corresponding refractions are hence called *mean refractions*. When these instruments stand above or below 30 and 50, it becomes necessary to apply a correction to the mean refraction, which correction is frequently put down for 1 inch of barometer above or below 30 and for 1° of thermometer above or below 50, either in the same table with the mean refraction or in a separate table. (See Naut. Table, p. 379.) But the most easy way of proceeding is to compute the true refraction from the mean by a short logarithmic process similar to the one given below. It may first be necessary to explain briefly the principles on which the correction in question is found.

From experiment it has been ascertained, that for a given angle of incidence in air, the refraction is proportional to the density of the air, so that if the supposed density, when the barometer is at 30 and thermometer at 50, be denoted by d and another density by d' , the new or true value of refraction will be equal to the mean refraction multiplied by $\frac{d'}{d}$; that is, if r = mean refraction and r' = true refraction, $r' = r \cdot \frac{d'}{d}$. Now if the thermometer be supposed to remain stationary at 50, in that case the density of the air must be proportional to the height of the barometer, and may be measured by that height. But supposing the thermometer to stand above 50, then, for two reasons, the said height cannot be a correct measure of the air's density: first, because the elasticity and consequent pressure of the air being increased by the heat, the quicksilver in the barometer would rise, although its specific gravity remained unchanged; secondly, because the quicksilver being expanded by heat, it would require a still greater column in order to balance the said increased pressure of the air.

1. Let b = height of barometer at the time of an observation, the thermometer standing at $50^\circ + t^\circ$ or $50 + t$.

2. Let b' = height of barometer, supposing the thermometer to stand at $50 + t$, but the quicksilver to maintain the same specific gravity as if it stood at 50.

3. Let b'' = height of barometer, supposing the thermometer to have actually stood at 50 at the time of the observation.

Then, if α = increase of expansive force of air for 1° of thermometer above 50 the barometer being at 30, and the expansive force of air for 50 be denoted by 1, it follows that

b'' must be less than b' in the proportion of 1 to $1 + \alpha t$, that is, $b'' = \frac{b'}{1 + \alpha t}$. Again,

if β = expansion of quicksilver in barometer for 1° of thermometer above 50, and the height of barometer for 50 be denoted by 1, then b' will be less than b , in the proportion of 1 to $1 + \beta t$, that is, $b' = \frac{b}{1 + \beta t}$. Hence $b'' = \frac{b}{1 + \alpha t \cdot 1 + \beta t}$. But $\frac{b''}{30} = \frac{d'}{d}$,

hence $r' = r \cdot \frac{d'}{d} = \frac{r b''}{30} = \frac{r b}{30 \cdot 1 + \alpha t \cdot 1 + \beta t}$. In like manner, when the thermometer is

t° below 50, we have $r' = \frac{r b}{30 \cdot 1 - \alpha t \cdot 1 - \beta t}$. In logarithms therefore $\log. r = \log. r + \log.$

$b + \text{ar. co. log. } 30 \cdot 1 \pm \alpha t \cdot 1 \pm \beta t - 10$. The subjoined table contains ar. co. log. 30. $1 \pm \alpha t \cdot 1 \pm \beta t$; so that the true refraction corresponding to any given heights of the barometer and thermometer may be very easily computed by the following rule,

RULE.—Add together; log. of mean refraction in seconds; log. of height of barometer in inches; and the number in column T. corresponding to the height of thermometer in degrees; rejecting 10 in the index of sum. The result will be the log. of true refraction.

$T = \text{Ar. Co. Log. of } 30 \cdot 1 \pm \alpha t \cdot 1 \pm \beta t; \alpha = \cdot 0020361; \beta = \cdot 0001001.$

Ther.	T.	Ther.	T.	Ther.	T.	Ther.	T.	Ther.	T.	Ther.	T.	Ther.	T.
15°	8°556510	25°	8°546656	35°	8°537002	45°	8°527540	55°	8°518262	65°	8°509162	75°	8°500231
16	°555516	26	°545681	36	°536047	46	°526603	56	°517344	66	°508261	76	°499347
17	°554523	27	°544709	37	°535095	47	°525670	57	°516428	67	°507362	77	°498464
18	°553532	28	°543739	38	°534144	48	°524738	58	°515514	68	°506465	78	°497584
19	°552544	29	°542771	39	°533195	49	°523807	59	°514601	69	°505569	79	°496705
20	8°551557	30	8°541804	40	8°532247	50	8°522879	60	8°513691	70	8°504675	80	8°495827
21	°550573	31	°540840	41	°531302	51	°521952	61	°512782	71	°503783	81	°494951
22	°549591	32	°539878	42	°530359	52	°521027	62	°511874	72	°502893	82	°494077
23	°548610	33	°538917	43	°529417	53	°520104	63	°510968	73	°502004	83	°493204
24	°547632	34	°537959	44	°528478	54	°519182	64	°510064	74	°501116	84	°492333

Ex. Let app. zen. distance = 70° , and mean refraction = $2' 39''$ or $159''$. Let barometer stand at $28 \cdot 8$ and thermometer at 66° : required the true refraction.—The log. of 159 is $2 \cdot 201397$; log. of $28 \cdot 8$ is $1 \cdot 459392$; and number T in table corresponding to 66° of thermometer is $8 \cdot 508261$. The sum of these, rejecting 10 in the index, is $2 \cdot 169050$, the nat. number corresponding to which is $147 \cdot 59$, the seconds in true refraction: that is, the true refraction is $2' 27'' \cdot 59$.

Having computed, therefore, the mean refraction for any proposed app. zen. distance as in the rule p. 244, the true refraction may be thus deduced for any given state of the air indicated by the barometer and thermometer. And as far as 80° or even 85° of zen. distance, that is, to within about 5° in altitude from the horizon, the result will be sufficiently exact. But nearer the horizon than this, there are causes which render the said result less to be depended on. The principle, from which the expression got above for r' is derived, is this,—that the refraction is proportional to the density of the air at the place of the observer. This supposes the whole refraction to take place at once in entering the air there, or that the ray of light, in its transit thither, has passed through parallel laminae of air; neither of which suppositions is true. The ray is, in fact, refracted by convex laminae deviating considerably from parallelism; so that the change of its direction is greater for any alteration in the air than a simple proportion to the density would give. If we had new values of m , of α , and $\log. b$ (see p. 244), for distinct heights of the barometer and thermometer above or below 30 and 50, it is possible that a law might be found which would give the true refraction, more correctly, down to the horizon. Or, if we knew the exact law according to which the temperature of the air changes upwards, upon which the alteration of density greatly depends, we might, by the aid of mathematical investigation, arrive at more exact conclusions on this point from experiments made on the refractive power of air at the earth's surface. Several very eminent persons have with this view applied the utmost resources of mathematical skill, assuming a law of variation of the air's temperature upwards rendered probable by what is found to take place at accessible heights; and the results so obtained have been given either in formulæ of easy application or in tables. One of the most able investigations on the subject in question is that of Ivory, printed in the 'Phil. Transactions' for 1823. The seconds deduced from his formulæ for correcting refractions near the horizon will be seen in the following table, that is, the seconds by which the true refraction, got as above from the mean refraction, is to be further corrected.

For barometer multiply the number in table by inches above 30 and add; or below 30 and subtract.

For thermometer multiply by degrees above 50 and subtract; or below 50 and add.

Zen. Dist.	80	81	82	83	84	85	86	87	88	88 30	89	89 20	89 40	90
For 1 inch Bar....	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	0.04	0.05	0.08	0.11	0.16	0.25	0.39	0.68	1.26	1.79	2.61	3.41	4.54	6.12
	"	"	"	"	"	"	"	"	"	"	"	"	"	"
For 1° Ther.	0.030	0.040	0.053	0.074	0.107	0.159	0.248	0.410	0.722	0.987	1.380	1.749	2.241	2.909

Ex. The mean refraction at the app. zen. dist. 90° being taken $33' 53''$ or $2033''$, the true refraction found as by rule above, for bar. 31 and ther. 62, is $2048'' \cdot 2$. Taking the numbers from this table, we have $6'' \cdot 12 \times 1$, or $6'' \cdot 12$ to add, and $2'' \cdot 909 \times 12$, or $34'' \cdot 908$ to subtract. Thus we get the corrected true refraction = $2019'' \cdot 4$, or $33' 39'' \cdot 4$.

Nearer to the horizon, however, than 4° or 5° , it seems that neither the most refined theory nor the most exact observations, as suggested above, can remove the uncertainty of refraction, for the following reason. Changes are perpetually taking place in the temperature and therefore in the density of different laminae of air floating near the earth, through which a horizontal ray passes, of which changes the barometer and thermometer where the observer is placed give no indication; and the effect of them on the refraction cannot be afterwards compensated, as in parallel laminae, on account of the convex surfaces on which the ray impinges at rapidly increasing angles of incidence. The error produced enters therefore wholly or partly into the entire refraction. No assumed law of temperature or deductions from practical observations can meet the difficulty hence arising with success. And it may be concluded, therefore, that no entire confidence can be placed in the results of smaller altitudes than about 5° , when in the necessary computations incident thereon, as in finding the longitude by lunar observation, the refraction enters as an important element.

To find Vertical Elevation of one Station above another by Barometer and Thermometer.

In figure p. 54 of Naut. Astron. A and D may be considered as any points within the earth's atmosphere, of which D is the higher. Then, since the pressure of the superincumbent air at D is less than at A, the quicksilver in the barometer, which is supported by this pressure, must be lower at D than at A, the difference of heights at which it stands being modified in some measure by the temperature of the air and also by that of the quicksilver in the barometer at these two stations (see foregoing observations, p. 245). By noting the heights at which the barometer stands, both at A and D, if possible at the same instant, and also the heights at which the thermometer stands, both in air and in the barometer, the latitude of the place being supposed to be nearly known, we are enabled to compute the vertical elevation of D above A. The following formula for making this computation is given in Miller's 'Hydrostatics,' p. 31, being reduced to the degrees of Fahrenheit's thermometer, instead of those of centesimal thermometer, as used in that treatise. Let δ = difference between the sum of thermometer heights in air and 64° ; δ' = difference between thermometer heights in barometer; B = greater barometer height, b = less; l = latitude of place; h = vertical elevation required in feet. Then,

$$h = \{60345 + 66 \cdot 666 \dots \delta + 155 \cos. 2 l\} \cdot \{\log. B - \log. b - 0.0004333 \dots \delta'\}$$

whence we derive the following rule, the subjoined table containing the value of $0.0004333 \dots \delta'$.

RULE 1.—Add together the heights of the thermometer in air, and take the difference between the sum and 64° . To the log. of this difference add 1.823912 . Take out the *nat. number* of the sum, and mark it (*a*).

2. To log. $\cos.$ * of twice the latitude add 2.190833 , rejecting 10 in the index. Take out the *nat. number* of the result, and mark it (*b*).

3. Find the logs. of the barometer heights, and take their difference, which mark (*c*). From (*c*) subtract A in subjoined table corresponding to difference of thermometer heights in barometer, and mark the remainder (*d*).

4. Under 60345 put (*a*). When the sum of thermometer heights in air is greater than 64° add, when less than 64° subtract. Under result put (*b*). When the latitude is less than 45° add, when greater than 45° subtract. Mark the result (*e*). Then to log. (*e*)

* When twice lat. is greater than 90° , take log. *sin.* of excess above 90° .

add $\log.* (d)$, rejecting 10 in the index of sum. The result will be the $\log.$ of the vertical elevation required in feet.

$$A = \cdot 0000433 \dots \times \text{Diff. of Heights of Ther. in Bar.}$$

Diff. Ther. in Bar.	A	Diff. Ther. in Bar.	A	Diff. Ther. in Bar.	A	Diff. Ther. in Bar.	A	Diff. Ther. in Bar.	A	Diff. Ther. in Bar.	A	Diff. Ther. in Bar.	A	For Tenths
0°	·000000	10°	·000433	20°	·000867	30°	·001300	40°	·001733	50°	·002167	60°	·002600	·1 4
1	· 043	11	· 476	21	· 910	31	· 1343	41	· 1777	51	· 2210	61	· 2643	·2 9
2	· 087	12	· 520	22	· 953	32	· 1387	42	· 1820	52	· 2253	62	· 2687	·3 13
3	· 130	13	· 563	23	· 997	33	· 1430	43	· 1863	53	· 2297	63	· 2730	·4 17
4	· 173	14	· 607	24	·001040	34	· 1473	44	· 1906	54	· 2340	64	· 2773	·5 22
5	·000216	15	·000650	25	· 1083	35	·001517	45	·001950	55	·002383	65	·002817	·6 26
6	· 260	16	· 693	26	· 1127	36	· 1560	46	· 1993	56	· 2427	66	· 2860	·7 30
7	· 303	17	· 737	27	· 1170	37	· 1603	47	· 2037	57	· 2470	67	· 2903	·8 34
8	· 346	18	· 780	28	· 1213	38	· 1647	48	· 2080	58	· 2513	68	· 2947	·9 39
9	· 390	19	· 823	29	· 1257	39	· 1690	49	· 2123	59	· 2556	69	· 2990	

Ex. The thermometer stands both in the air and in the barometer at 77·6 and 70·4. The barometer stands at 30·05 and 29·66; the latitude of the place is 21° nearly. Required the difference in height of the two stations. Sum of thermometer heights in air = 148. Diff. between this and 64 = 84.

Log. 84..1·924279	Log. $\cos. 42^\circ$..9·871074	Log. 30·05..1·477844	60345
1·823912	2·190833	Log. 29·66..1·374015	5600·04+
3·748191	2·061907	(c) 0·103829	65945·04
5600·04 (a)	115·32 (b)	A 0·000312	115·32+
		(d) 0·103517	66060·36(e)
		Log. (e) 4·819941	
		* Log. (d) 9·015012	

Height reqd.6838·4 ft. Log.3·834953

When the height required is very considerable, the variation of gravity between the stations should be taken into the account. A proper allowance for this variation may be found as follows. See Miller's 'Hydrostatics,' p. 31.

5. To $\log.$ of (c) add 2·422914, rejecting 10 in index. Find *nat. number* corresponding to result, which add to (e), and then subtract 87. With the result proceed as above with (e).

Ex. As above, Log. (c) 9·016323 (Note*).
2·422914

Log. 6000·86....4·819550
Log. (d)9·015012

Log.1·439237
Nat. number 27·5 +
(e) 66060·36

3·834562

Height reqd. 6832·2 feet.

66087·86
87 —
66000·86

(7.) Let half the earth be supposed to be placed on the plane of the paper, and the other half immediately under it below the paper, the two flat sides close to each other and to the paper. And let the sun be supposed to be at a great distance on the said plane. Then every particle of matter in the half of the earth facing the sun, being nearer to

* The index must be as many units *less* than 10 as the first significant figure in (d) is from the place of units, supposing the figure in the unit's place of (d) is 0. (See note to App. 11.)

that body than the earth's centre, will receive a greater impulse towards the sun from solar attraction than the centre. The mass therein, therefore, which is above the paper, will tend to turn towards the sun; as also the mass therein under the paper. And these tendencies will be in opposite directions. If the earth were exactly spherical, the two masses being similar, and similarly situated with respect to the sun, there would be an equilibrium, that is, no motion of rotation towards the sun could ensue. But the earth is really of a spheroidal form, protuberant towards the equator and flattened towards the poles. We may, as to the effect under consideration, suppose it to consist of an interior sphere, surrounded by and attached to a protuberant ring of matter lying on the equator itself. Then the solar attraction on the interior hemisphere will be balanced as just shown; but the equatorial ring will not always be so. Let the equator be so placed as to have a greater part thereof above the paper, in the half of the earth facing the sun, than there is below, that is, let the sun be supposed to have south declination. In this case it is manifest that the tendency of the mass above to turn towards the sun downwards, will be greater than the counter tendency from below to turn upwards. So that upon the whole there will be a tendency to turn downwards; and, since the particles of matter in the equatorial ring are equally distributed round the earth, such tendency must take place round an axis lying on the paper, and perpendicular to a line joining the centres of the earth and sun. Consequently the terrestrial pole will move, independently of any other rotatory tendency, towards the sun in the arc of the meridian on which the sun is situated. But the earth has, in fact, another tendency to revolve, namely, its diurnal one from west to east, which so greatly exceeds that just mentioned, as to be scarcely affected by it. As the earth revolves from west to east, each particle is carried round in a circle parallel to the equator, and when it reaches the place of the meridian perpendicular to that on which the sun is situated, its motion is directly opposite to the tendency to turn towards the sun. At some point, therefore, in such meridian, which must be very near the terrestrial pole, the two tendencies from west to east and towards the sun must be balanced. Such point will be for an instant quiescent, and constitute, as it were, a new terrestrial pole, round which the true pole will begin to revolve from west to east. This new pole, however, as the sun's position is changed from its annual motion, will itself shift, being always found on a meridian at right angles to the meridian passing through the sun. So that the motion of the true pole will be constantly round the new pole, which is itself in motion. But the distance of the former from the latter is so small, that it may be considered as describing the line on which the latter, that is, the new pole, is carried. These effects will appear more distinctly from the figure subjoined and its description.

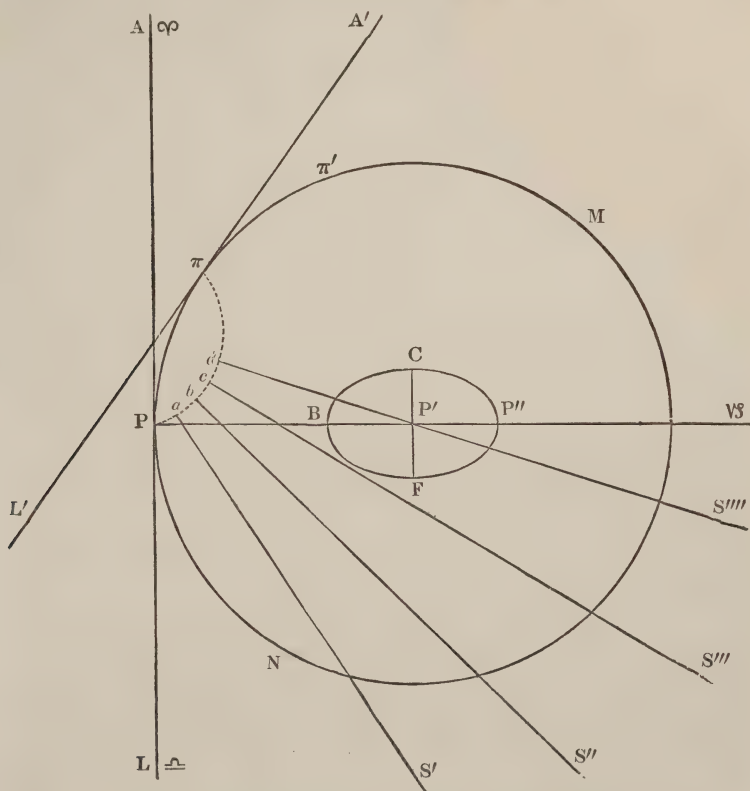
The half of the earth on the side opposite to the sun will also receive a similar impulse, in consequence of the protuberant equatorial ring, which in the supposed position thereof has a greater part under the paper than above. The particles in this half experience a *less* attraction towards the sun than the central point, being at a greater distance from that body. The effect must, therefore, be as if they were *more* attracted in the opposite direction; that is, they will acquire a tendency to turn towards the paper, and the part below the paper, having on it a greater portion of the ring, will exceed in this tendency the part above; so that, upon the whole, this half of the earth will, independently of any other force, carry the pole towards the sun, in the same direction as before, on the meridian passing through the sun.

If the protuberant ring pass under the sun, that is, if the sun be supposed to be shifted on the paper to the opposite side of the earth, in that case it may be easily shown as above, that the south pole of the earth will be drawn towards the sun, and therefore the north pole will recline towards the former place of the sun in the same direction as before.

It appears, therefore, that whenever the sun has north or south declination, the north pole of the earth will shift, as the sun continues its annual motion, always into a line at right angles to the meridian on which the sun is situated, that is, on a meridian 90° eastward of it. Now, whatever changes of place the pole of the earth undergoes, the celestial pole must undergo also; that is, the celestial pole will constantly be shifted in a slight degree on a line perpendicular to the celestial meridian or circle of declination passing through the sun.

Let the sun be supposed to begin its annual motion from the first point of *Libra* *L* (see adjoining figure) through the positions S' , S'' , S''' , &c. Let *P* be the celestial pole, and *P M N* a parallel of latitude round the pole of the ecliptic P' ; $P P'$ being the inclination of the equator to the ecliptic (Art. 95, Naut. Astronomy). Then *P* will be first transferred in the circumference of a circle of declination perpendicular to $P S'$ as to a , secondly, to b , $a b$ being perpendicular to $a S''$; and so on. It appears thus, that while the sun passes from *L* towards the first point of *Aries* as *A*, the pole *P* must describe a curve perpendicular to $P S'$, $a S''$, $b S'''$, $c S''''$, &c. Consequently, it must be transferred at first almost directly towards P' , and then less and less so, till the sun comes to S'''' , and is, with

respect to the new place of the pole, in the solstitial colure dS''' . The pole must afterwards turn again towards the small circle PMN , always shifting in a direction perpendicular to dS''' , dS''' , &c.; and when the sun comes to the first point of *Aries*, the pole must be again in the circumference of that small circle, as at π ; when, supposing $A' \pi L'$ to touch this circle at π , A' , which is to the *west* of A , must be the first



point of *Aries*, and L' , west of L , the first point of *Libra*. And as the distance of the pole (thus transferred) from P' always measures the inclination of the equator to the ecliptic, it appears that this inclination decreases as the sun moves from L to S''' , the summer solstice, and again increases to its former value as the sun moves from S''' to A' .

As the sun goes on from A' , the first point of *Aries*, to the first point of *Libra* again, having the nearest protuberant part of the earth to the south, effects similar to the above must be produced on the south pole, that is, the point opposite to π , and thus π must be transferred again through another small arc, as to π' ; alternately, at the same time, approaching and receding from P' .

Effects similar to those described above are produced also by the attraction of the moon, as it is carried round the earth each month in an orbit inclined to the equator. Though much less in point of real magnitude, yet, from its comparative nearness to the earth, the moon's apparent magnitude does not differ much from that of the sun. So that, if the said lunar orbit coincided with the ecliptic, and the density of the moon were equal to that of the sun, the average annual deviation of the celestial pole would be nearly the same for either body. But in fact the moon's orbit is inclined to the ecliptic at an angle of about $5^\circ 9'$. Its position also is changing continually, in the same manner and for a similar reason that the terrestrial equator shifts its situation. For being carried round the sun together with the earth, twice in the year the points of its intersection with the plane of the ecliptic (which are called its *nodes*) are situated in a line with the sun. At other times

the sun is above or below the plane in which the moon is moving. The latter body is consequently drawn from that plane, and the lunar orbit—supposed to accommodate itself, like an inflexible hoop, to these disturbed motions, by varying its position so as always to keep the moon therein—carries the *nodes* from east to west on the ecliptic. At the same time it has a libratory motion towards and from the ecliptic, being more or less inclined thereto according to the direction of the line of nodes with respect to the sun. The greatest inclination, which is about $5^{\circ} 18'$, takes place when this line is pointed to the sun; the least, which is about 5° , takes place when this line lies 90° from that situation.

In consequence of thus shifting the points of its intersection with the ecliptic, the moon's orbit continually changes its inclination to the equator, independently of the variation of the angle it makes with the former circle. When the *ascending node*—that is, the intersection of the orbit with the ecliptic at which the moon passes to the north—is in the first point of *Aries*, this inclination is the greatest; for then the moon's orbit being wholly on a different side of the ecliptic from the equator and cutting it at the same points with the equator, the inclination in question must be about $23^{\circ} 28' + 5^{\circ} 9'$, or $28^{\circ} 37'$. On the other hand, when the *descending node* is in the first point of *Aries*, the lunar orbit lies then wholly between the ecliptic and the equator, so that its inclination to the latter must be about $23^{\circ} 28' - 5^{\circ} 9'$, or $18^{\circ} 19'$. At other times the angle of inclination varies between these limits, being a mean, or about $23^{\circ} 28'$, when the nodes are in the first points of *Cancer* and *Capricorn*.

The nodes of the lunar orbit make a complete revolution from *east to west* in about 18 years and 7 months. The angle, therefore, which it makes with the ecliptic, goes through all its changes in the same period. And, as the nodes thus recede on the ecliptic, it is evident that the pole of the orbit must recede equally round the pole of the ecliptic, making an entire revolution round it, at the distance of about $5^{\circ} 9'$, in 18 years and 7 months.

Let the *ascending node* of the moon's orbit be supposed to be in the first point of *Aries* A (see fig. p. 250), and consequently the *descending node*, or opposite point, in the first point of *Libra* L. And let the moon begin its motion round the earth from L. Let P, P', and P'', be respectively the poles of the equator, the ecliptic, and the lunar orbit, which points at this time must have the relative position assumed in the figure. Let the small circle P'' F B C be a parallel to the ecliptic. Now we have seen that, by the disturbing force of the sun, the celestial pole is shifted every half-year, along a parallel to the ecliptic, deviating in the mean time something *towards* and again *from* the pole of the ecliptic P'. In like manner, by the disturbing force of the moon, the celestial pole, during every fortnight, or half-revolution of the moon round the earth from node to node, is shifted on a parallel to the lunar orbit, whose pole is P''; the deviation in this case *towards* and *from* P'' being for that short interval imperceptible.

The curve, therefore, in which the celestial pole is shifted by the action of the moon, is always perpendicular to a circular arc lying between the said pole and P''. Such a curve must manifestly *approach* P', while P'', by its retrograde motion, as described above from east to west, is carried round P' from P'' through F to B, that is, while the *ascending node* moves from *Aries* to *Libra*; and it will recede from P', as P'' continues its retrograde course from B through C to P'' again, or as the node passes from *Libra* to *Aries*. At the end of the whole period of 18 years and 7 months it will be at the same distance from P' as before. The velocity of this approach to and retreat from P', as well as of its transmission westward, must depend on the amount of the disturbing force, which varies with the inclination of the lunar orbit to the equator, and also on the position of P'' with respect to P.

Considering the disturbing forces of both the sun and moon, it appears that when the ascending node of the lunar orbit is at a solstice, and the sun is half-way between an equinox and a solstice, the celestial pole is at its mean distance from the pole of the ecliptic. A point may be supposed to preserve invariably this distance therefore, and be considered as the *mean pole*, being carried uniformly from east to west, entirely round the pole of the ecliptic, in about 26,000 years, with the mean westerly motion of the true pole, considering both the solar and lunar disturbing forces. The true pole, from the action of the sun, will deviate from this: first, by the inequalities of its western motion; and, secondly, by its alternate approach to and recession from the pole of the ecliptic. The correction of the place of the mean pole, on this account, may be found by supposing a second point to describe a circle uniformly from east to west round the mean pole, having a diameter of $0''.4$ in divisions of a great circle. This circle is supposed to be described every half-year, and the point to be at the most distant part at an equinox.

From the action of the moon the true pole is sometimes found to the west and sometimes to the east of the mean pole; and while the ascending node of the lunar orbit recedes from a solstice through *Libra* to the next solstice, it will be *within* the mean distance from

the pole of the ecliptic, and the next 9 years and $3\frac{1}{2}$ months *without* it. The correction on this account may be found by supposing a third point to describe, in 18 years and 7 months, an ellipse, with an uniform angular motion round the mean pole, having its greater diameter ($18''\cdot5$) directed to the pole of the ecliptic, and its less diameter ($13''\cdot7$) coinciding with the mean circle. The point is supposed to be at its most distant part from the pole of the ecliptic when the ascending node is in Aries.

In the above observations the ecliptic has been considered as a fixed circle. But from the annual amount of the attraction of the planets, the earth is drawn out of its orbit round the sun in a slight degree; in other words it does not describe orbits which lie exactly in the same plane. So that the plane of the ecliptic undergoes a constant change, and consequently its pole P' is shifted. On this account, therefore, the solstitial colure $P'P$ must alter its position, and therefore the solstices must do so, as also the equinoxes, which are always 90° distant therefrom. At the same time a variation must take place in the inclination of the equator to the ecliptic, by which the effects described above of the sun and moon's disturbing forces must be somewhat modified. In estimating the regression of the equinoxes, therefore, it is necessary to take the planetary attraction into consideration. The effect thereof is not always the same, or of the same kind, though the variation is very small. For a certain period of time the equinoxes are hereby made to advance, that is, to shift from west to east. At the beginning of the Christian era they advanced about $47''$ in a year. At present they advance about $16''$ in a year. In process of time this advance will cease, after which they will begin to recede: in like manner the inclination of the equator and ecliptic (called the *obliquity*) is thus alternately increased for a long series of years, and then diminished again. These variations change so slowly, that for one or two centuries they may be considered constant, and on this account are called *secular variations*. The secular variation of the obliquity is now about half a second annually, by which the obliquity is diminished.

The mean annual regression of the equinoxes on the ecliptic, produced by the disturbing forces of the sun and moon, is about $50''\cdot3538$, which is called *luni-solar precession*. The variation at any time from this rate of receding, on account of inequalities in the effects of these forces, has been called *luni-solar nutation*, with a reference probably to the deviation of the celestial pole from the small circle it is first supposed to describe uniformly round the pole of the ecliptic. That part belonging to the sun's action is called *solar nutation* or *solar inequality*; that part belonging to the moon's action is called *lunar nutation*. Similar terms are applied to the variations thus produced from the mean alteration in the inclination of the equator and ecliptic, or the *obliquity*.

The annual advance of the equinoxes from planetary attraction is now about $0''\cdot12$; so that the *whole precession* is $50''\cdot35 - 0''\cdot12 = 50''\cdot23$. This is to be understood by the term *precession*, when used alone.

The greatest solar nutation in precession is about $1''$, in obliquity about $0''\cdot4$. The greatest lunar nutation in precession is about $18''$; in obliquity it is about $9\frac{1}{2}''$.

The discovery of the precession of the equinoxes is due to Hipparchus, who lived about 120 years before Christ, and who determined by observation very nearly its true value. The physical cause of the precession was first pointed out by Newton, who also mentioned a libration of the earth's axis, of which the period was six months; the effect thereof on the equinoxes he considered as almost insensible. The interesting and important discovery of lunar nutation was made by Bradley. In observing stars near the zenith, he found a discordance between their calculated and observed places, one part of which varied through the year, and then recurred in the same order as before. This led him to the detection of the small apparent motion in the fixed stars called *aberration*. (See Art. 147, Naut. Astron.) Continuing his observations afterwards, he still found that the apparent places of stars differed from the computed, although he made an allowance for aberration. The period of the variations noted proved to be the time in which the nodes of the moon's orbit make a complete revolution; this led him to the discovery of lunar nutation.

(8.) The progressive motion of light was first discovered by Roemer, a Swedish astronomer. He found that the actual time, as observed, of the emersion of a satellite out of the shadow of Jupiter (see Art. 296 of Naut. Astronomy) seemed to depend in some measure on the place of the earth in its orbit round the sun;—that when the earth was in the part of its orbit farthest from the planet, the said time seemed greater, as compared with the computed time, than when it was in a part of its orbit nearer thereto. And, on examining the differences, he found they might be satisfactorily explained by supposing light from the planet not to be transmitted to the earth instantaneously, as previously imagined, but to take some time in doing this—to be *progressive*. He concluded, in order

to reconcile his observations to one another, that light was $16^m 26^s$ in traversing the earth's orbit, and therefore $8^m 13^s$ in passing from the sun to the earth. This conclusion enabled Bradley to explain his discovery of the aberration of the fixed stars; and this explanation, applicable without error to an infinite number of stars situated in every part of the celestial concave, affords a very decided proof not only of the correctness of Roemer's conclusion, but also of the earth's actual motion round the sun.

In Art. 149, Naut. Astronomy, the deviation of impression by light on the eye is considered as caused by the motion of the spectator round the sun. The fact of aberration may perhaps be more clearly understood as follows. It is well known that when the hand is moved from right to left, a ball thrown up and again falling cannot be properly caught in a tube, unless that tube be inclined to the left. In like manner, in order that a ray of light from a star may move down the middle line or axis of a telescope (which it must do for the instrument to measure the star's place), the telescope, being at the same time moved round the sun, suppose from right to left, must be inclined to the left, and will therefore determine the star's place as if it were to the left of its real or true direction. In general it thus appears, that a star's place will be determined by the instrument, except in particular cases, at a little distance from its true place, always in a circle whose plane passes through the true place and through the line of the earth's motion.

(9.) *Proper motion* of a fixed star is considered in Art. 156 of Naut. Astronomy, to be what its observed R.A. and declination differ from those which are determined from astronomical tables, by bringing up the mean R.A. and declination fixed for some previous epoch to the time of observation, and applying thereto the necessary corrections for nutation and aberration. This, however, is not, or rather may not be, the entire result of the actual individual movement of the star, for the following reason. The value of precession used in bringing up the mean R.A. and declination is determined, in conjunction with theory, by comparing the places of as many stars as possible, got from correct observations at periods distant from each other. The result of such a comparison must therefore include the effect of any actual movement in the stars, of which the cause and laws are unknown. The correction of the mean R.A. or declination of a star for precession, together with the annual amount of proper motion (if any), is put down in the Nautical Almanac for 100 principal fixed stars, and is called *annual variation*; those stars having proper motion being marked with an asterisk.

It has been supposed that a small apparent change of place in some of the fixed stars from $1''$ to $4''$ is occasioned by the transference of the observer from one point in the earth's orbit round the sun to the opposite point, a distance of about 190 millions of miles. This apparent change (if it exist) is called *annual parallax*.

(10.) Formulæ are given in the 'Nautical Almanac' expressing the relation between the *mean* place of a fixed star and its *apparent* place: the former being supposed known for a given epoch, namely, the commencement of some stated year, as January 1, 1830, 1840, &c.; and the latter being required for some subsequent Greenwich date, as Gr., May 2, 18^h 30^m. Examples are also given in the 'Nautical Almanac' of the process by which the latter, that is, the app. R.A. and decl. of a star may be found, so that the operation of reduction is made there sufficiently plain. Yet to the seaman the following direct rule may perhaps be of some use.

(11.) Rule applicable to any fixed Star.

1. Get a Greenwich date, as in Art. 185 of Naut. Astronomy, or the note thereto. Under the *mean* R. A. of the star for the known epoch, always marked +, put the amount of *ann. precession in* R. A. for the subsequent whole years, with the proper sign + or -. Again, under the *mean decl.* of the star for the known epoch, marked + when N., and marked - when S., put the amount of *ann. precession in decl.* for the subsequent whole years, with the proper sign + or -. In each case take the sum when the signs are *like*, marking it with the common sign, and take the difference when the signs are *unlike*, marking it with the sign of the greater. The results will be the *mean* R. A. and *mean decl.* of the star at the beginning of the proposed year, the former of which mark (*a*) and the latter mark (*d*).

2. For the Gr. date take from the 'Naut. Almanac' the values of *f*, *g*, *G*, *h*, *H*, *i*, (see following example), observing that these are given in the 'Naut. Almanac' for

Gr. midnight. Turn* (a) into $^{\circ}''$ and add the result to G, marking the sum (diminished by 360° if greater than 360°) S. Again add (a) turned into $^{\circ}''$ to H, and mark the sum (diminished by 360° if greater than 360°) S'. Write down g, *sin.* S, &c. under each other, as in the subjoined form, affixing the proper sign + or - to each (see table in note†), and leaving proper spaces between the columns for the logarithms.

g	h	g	h	i
<i>sin.</i> S.	<i>sin.</i> S'.	<i>cos.</i> S.	<i>cos.</i> S'.	<i>cos.</i> (d)
<i>tan.</i> (d)	<i>sec.</i> (d)		<i>sin.</i> (d)	

Take from the tables the logarithm of g, log. *sin.* S, † &c. and write them in the spaces of the form opposite to g. *sin.* S, &c. Add up each column of logarithms, rejecting the tens from the index of each sum, and then take from the tables the *nat. numbers* ‡ corresponding to these logarithmic sums, marking each + when in the column above there is an even number of signs - or none, and marking each - when there is in the column above an odd number of signs -.

3. Find the aggregate § of f , of the first two *nat. numbers*, and of proper motion of star in R. A. (if any) for fraction of proposed year. Turn this aggregate into time by dividing by 15, and apply the result with its proper sign to (a). The result will be the required *app.* R. A. of the star.

Again, find the aggregate of the last three *nat. numbers*, and of proper motion of star in decl. (if any) for fraction of proposed year, and put this aggregate under (d), with its proper sign + or -. The sum, if the signs be like, with the common sign; and the difference, with the sign of the greater, if the signs be unlike, will be required *app. decl.* of the star.

Ex. At $6^h 30^m$ after midnight on May 2, at Greenwich, required the *app.* R. A. and *app. decl.* of α Aquilæ (Altair), its mean R. A. and mean decl. for the beginning of 1840 being supposed $19^h 42^m 58^s.555$, and $8^{\circ} 27' 0''.22$ N., the ann. precession in R. A. being + $2^s.9255$, inclusive of an ann. proper motion of + $0''.51$ in space, and the ann. precession in decl. being + $8''.713$.

* This may be easily done by means of the table of log. *havversines* (see Nautical Tables); dividing the value of (a), if greater than 12^h , into two parts, namely, 12^h , which give 180° , and the excess of (a) above 12^h ; which parts add together.

† In taking out log. *sin.* S, &c., look for what S wants of 180° , when it lies between 90° and 180° ; for what S is above 180° , when it lies between 180° and 270° ; and for what S wants of 360° , when it lies between 270° and 360° . Thus also for S'.

Arc + between					Arc - between				
	0° and 90°	90° and 180°	180° and 270°	270° and 360°		0° and 90°	90° and 180°	180° and 270°	270° and 360°
<i>Sin.</i>	+	+	-	-	<i>Sin.</i>	-	-	+	+
<i>Cos.</i>	+	-	-	+	<i>Cos.</i>	+	-	-	+
<i>Sec.</i>	+	-	-	+	<i>Sec.</i>	+	-	-	+
<i>Tan.</i>	+	-	+	-	<i>Tan.</i>	-	+	-	+

N. decl. is +; S. decl. is -.

†	Units.	Tens.	Hundreds.	Thousands.	Tenks.	Hundredths.	Thousandths.	Tenths of Thousandths.
1st significant fig. in <i>nat. numbers</i> on the left.								
Index of log.	0	1	2	3	9	8	7	6

§ The difference between sum of those marked +, and the sum of those marked -, with the sign of greater sum. When all the signs are alike, the whole sum with the common sign.

	f	g	G	h	H	i
Gr. May 1, Midnight May 6, . . .	+27 ^m .40 +27 .98	+12 ^m .94 +13 .22	+22 ^m 45' +22 51	+19 ^m .43 +19 .57	+226 ^m 7' +221 17	-6 ^m .08 -5 .60
Change in 5 ^d . . .	+ 0 .58	+ 0 .28	+ 0 6	+ 0 .14	- 4 50	+ 0 .48
Change in 1 ^d 6 ^h . . .	+ 0.147	+ 0.071	+ 0 1 32 ^s	+ 0.036	- 1 13 43 ^s	+ 0.122
Required values .	+27.54 ^m	+13.011	+22 46 32	+19.466	+224 53 17	-5.958

M.R.A. 1835 ..	19 ^b 42 ^m	58 ^s .555+	M. Decl.	8° 27' 0" .22 +	G 22° 46' 32" +	H 224° 53' 17" +
Precession		14 .627+		43 .565+	295 48 15 +	295 48 15 +

M.R.A. 1845, (a) 19 43 13 ·182+ M. Decl. (d) 8 27 43 ·785+ 318 34 47 S. 160 41 32 S'.

	logs.		logs.		logs.		logs.
+ g.	1° 11'4311	+ h	2° 28'9500	+ g.	1° 11'4311	+ h	1° 28'9277
— sin. S.	9° 8'20573	+ sin. S'.	9° 5'19371	+ cos. S.	9° 8'74996	— cos. S'.	9° 9'74858
+ tan. (d)	9° 17'2478	+ sec. (d)	10° 0'04753			+ sin. (d)	9° 16'7725
(Adding)	0° 10'7362		0° 8'13624		0° 98'9307		0° 43'1860
Nat. num.	1° 29'03—		6° 5'1064		9° 7'568+		0° 77'0347
	f.		27° 5'47 +				5° 8'931—
	Prop. M.		0° 1'70 +				2° 7'031—
	Sum		34° 22'76 +				8° 5'962—
			1° 28'03—				9° 7'568+
			32° 9'473+				1° 16'06+
							(d) 8 27 43° 7'85 +
	In time	28° 19'565 +					Reqd. decl. 8 27 44° 95 +
	(a) 19 43	13° 1'82 +					[or N.
	19 43	15° 38	Reqd. R. A.				

(12.) The rule in Art. 198 of Naut. Astron. may be proved as follows. In fig. p. 44, of Naut. Astron. let X represent the mean sun; then $Q M$ in time = *mean time*, $A M$ or $M A = R. A.$ of *mean sun*, $A Q$ or $Q A = R. A.$ of *meridian or sidereal time*. And it is evident, whatever may be the places of M and A , that reckoning from Q in $R. A.$ the dist. of M *west* of meridian + dist. of A *west* of M = dist. of A *west* of meridian; that is, *mean time* + $R. A.$ *mean sun* = *sid. time*; supposing the sum to be less than 24 hours. When the sum is greater than 24 hours, then *mean time* + $R. A.$ *mean sun* = *sid. time* + 24 hours, since the distance of A *west* of Q must be reckoned in that case round to Q again, and thence farther *west* of Q . Hence, if *sid. time* be denoted by s , $R. A.$ of *mean sun* by p , and *mean time* by m , we have

$m + e = s$, or $m + e = 24^b + s$.
And, $s - e = m$, or $24^b + s - e = m$.

(13.) The rule in Art. 199 of Naut. Astron. may be proved as follows. Reckoning in R. A. in time, it is evident that the distance of a heavenly body, as X (fig. p. 44 of Naut. Astron.), *west* of meridian + dist. of A *west* of the body X = (either) dist. of A *west* of meridian, (or) dist. of A *west* of meridian + 24 hours. That is, if P = hour angle *west* of meridian, P + R. A. of body = (either) *sid. time* (or) *sid. time* + 24 hours. Hence, if $r = R. A.$ of body, and $s = sid. time$, we have:

$P + r = s$, or $P + r = 24^h + s$; hence $P = s - r$, or $P = 24^h + s - r$.

Putting $m + \rho$ for s (App. 12),

$$P = m + \xi - r, \text{ or } P = 24^h + m + \xi - r; \text{ also } m = P + r - \xi, \text{ or } m = 24^h + P + r - \xi.$$

(14.) (1.) If in fig. p. 44 of Nautical Astronomy, b be the place of a heavenly body on the meridian, then $Zb = ZQ - bQ$, that is, *mer. zen. dist.* = *lat.* - *decl.*, or $M. Z. = l - d$, $M. Z.$ denoting *mer. zen. dist.*, l the *lat.*, and d the *decl.* of the body.

(2.) If b' be the place of the body on the meridian, then $Zb' = ZQ + b'Q$, that is,

(3.) If a point as b'' be assumed between Z and P for the place of the body, then $M.Z. = d - l$.

In (1), d , having the same name as l , is considered as *positive* or $+$. In (2), where it has a different name from l , it is considered as *negative* or $-$. In (3), $M. Z.$, being reckoned in an opposite direction to that of ZQ , is to be considered as *negative* or $-$.

That is, in (1) $M. Z. = l - d$; in (2) $M. Z. = l - (-d)$; in (3) $M. Z. = d - l$, or $-M. Z. = l - d$. So that in all cases, when a body passes the meridian from east to west, $l - d$ is a proper expression for $M. Z.$, the algebraical signs being attended to.

It appears also that in (1) $l = M. Z. + d$; in (2) $l = M. Z. - d$; and in (3) $l = d - M. Z.$

(15.) Let a point b''' be assumed in fig. p. 44 of 'Nautical Astronomy,' between P and N, as the place where the body passes the meridian under the pole from west to east. Then PN = latitude, and $PN = Pb''' + b'''N$ = *polar dist.* of body + *mer. alt.* But *polar dist.* of body = $90^\circ - \text{decl.}$: consequently, $\text{lat.} = 90^\circ - \text{decl.} + \text{mer. alt.} = 90^\circ + \text{mer. alt.} - \text{decl.}$ As a heavenly body seen on the meridian under the north must have north decl., and under the south pole must have south decl., it is evident that the lat. is of the same name with the decl.

(16.) The three angles of a spherical triangle being denoted by A, B, C, and the sides respectively opposite to A, B, C, being denoted by a, b, c , it is well known that

$$\cos. A = \frac{\cos. a - \cos. b \cos. c}{\sin. b \sin. c}, \text{ from which and other very common trigonometrical formulæ}$$

are easily deduced the following:—

$$(\alpha) \dots \text{If } \text{vers. } \theta = \sin. b \sin. c \text{ vers. } A, \text{ or } \text{hav. } \theta = \sin. b \sin. c \text{ hav. } A, \text{ then } \text{vers. } a = \text{vers. } \theta + \text{vers. } (b - c)$$

$$(\beta) \dots \text{hav. } A \text{ or } \sin.^2 \frac{1}{2} A = \text{cosec. } b \text{ cosec. } c \sin. \frac{1}{2} (a + \overline{b - c}) \sin. \frac{1}{2} (a - \overline{b - c})$$

$$(\gamma) \dots \text{hav. } A \text{ or } \sin.^2 \frac{1}{2} A = \text{cosec. } b \text{ cosec. } c \text{ hav. } \frac{1}{2} (a + \overline{b - c}) \text{ hav. } \frac{1}{2} (a - \overline{b - c})$$

$$(\delta) \dots \cot. A \sin. B = \cot. a \sin. c - \cos. B \cos. c, \text{ or } \frac{\cos. A}{\sin. A} \sin. B = \frac{\cos. a}{\sin. a} \sin. c - \cos. B \cos. c.$$

Applying these formulæ to the triangle ZPX (fig. p. 44 of 'Nautical Astronomy') where X represents any heavenly body, Z the zenith, and P the celestial pole, let—

z = zenith distance ZX; a = altitude OX; complements of each other.

p = polar distance PX; d = declination XM; complements of each other.

P = hour angle ZPX; Z = azimuth PZX; X = angle ZXP; l = lat. or complement of ZP.

Then, putting $\cos.$ complement of arc for $\sin.$ arc, &c., and $l - d$ for polar dist. PX — colat. ZP.

1 .. If $\text{vers. } \theta = \cos. l \cos. d \text{ vers. } P$, or $\text{hav. } \theta = \cos. l \cos. d \text{ hav. } P$; then, $\text{vers. } z = \text{vers. } \theta + \text{vers. } (l - d)$. For log. tables, $\text{hav. } \theta = \cos. l + \cos. d + \text{hav. } P - 20$; and in nat. versines, $\text{vers. } z = \text{vers. } \theta + \text{vers. } (l - d)$.

2 .. If $\text{vers. } \theta = \cos. l \cos. d \text{ vers. } P$, or $\text{hav. } \theta = \cos. l \cos. d \text{ hav. } P$, then $\text{vers. } (l - d) = \text{vers. } z - \text{vers. } \theta$. For log. tables, $\text{hav. } \theta = \cos. l + \cos. d + \text{hav. } P - 20$; and in nat. versines, $\text{vers. } (l - d) = \text{vers. } z - \text{vers. } \theta$.

3 ... $\text{hav. } P \text{ or } \sin.^2 \frac{1}{2} P = \sec. l \sec. d \sin. \frac{1}{2} (z + \overline{l - d}) \sin. \frac{1}{2} (z - \overline{l - d})$. For log. tables, $\text{hav. } P = \sec. l - 10 + \sec. d - 10 + \sin. \frac{1}{2} (z + \overline{l - d}) + \sin. \frac{1}{2} (z - \overline{l - d}) - 10$.

4 .. $\text{hav. } P \text{ or } \sin.^2 \frac{1}{2} P = \sec. l \sec. d \text{ hav. } \frac{1}{2} (z + \overline{l - d}) \text{ hav. } \frac{1}{2} (z - \overline{l - d})$. For log. tables, $\text{hav. } P = \sec. l - 10 + \sec. d - 10 + \frac{1}{2} \text{hav. } (z + \overline{l - d}) + \frac{1}{2} \text{hav. } (z - \overline{l - d})$.

5 .. $\text{hav. } Z \text{ or } \sin.^2 \frac{1}{2} Z = \sec. l \sec. a \sin. \frac{1}{2} (p + \overline{l - a}) \sin. \frac{1}{2} (p - \overline{l - a})$. For log. tables, $\text{hav. } Z = \sec. l - 10 + \sec. a - 10 + \sin. \frac{1}{2} (p + \overline{l - a}) + \sin. \frac{1}{2} (p - \overline{l - a}) - 10$.

6 .. $\text{hav. } Z = \sec. l \sec. a \text{ hav. } \frac{1}{2} (p + \overline{l - a}) \text{ hav. } \frac{1}{2} (p - \overline{l - a})$. For log. tables $\text{hav. } Z = \sec. l - 10 + \sec. a - 10 + \frac{1}{2} \text{hav. } (p + \overline{l - a}) + \frac{1}{2} \text{hav. } (p - \overline{l - a})$.

$$7 .. \cot. P \sin. Z = \cot. z \cos. l - \cos. Z \sin. l, \text{ or, } \frac{\cos. P}{\sin. P} \sin. Z = \frac{\cos. z}{\sin. z} \cos. l - \cos. Z$$

$\sin. l$. Dividing former by $\sin. Z$, putting $\text{cosec. } Z$ for $\frac{1}{\sin. Z}$, $\tan. a$ for $\cot. z$, and $\cot. Z$

for $\frac{\cos. Z}{\sin. Z}$; $\cot. P = \text{cosec. } Z \tan. a \cos. l - \cot. Z \sin. l$.

$$8. \text{Cot. } X \sin. P = \tan. l \cos. d - \cos. P \sin. d, \text{ or, } \frac{\cos. X}{\sin. X} \sin. P = \frac{\sin. l}{\cos. l} \cos. d - \cos. P \sin. d.$$

$P \sin. d$. Dividing by $\sin. P$, putting $\frac{1}{\cot.}$ for $\tan.$ and $\frac{1}{\tan.}$ for $\frac{\cos.}{\sin.}$; $\cot. X = \frac{\cos. d.}{\sin. P \cot. l} - \frac{\sin. d.}{\tan. P}$

$$9. \text{Cot. } X \sin. Z = \tan. l \cos. a - \cos. Z \sin. a, \text{ or, } \frac{\cos. X}{\sin. X} \sin. Z = \frac{\sin. l}{\cos. l} \cos. a - \cos. Z \sin. a. \text{ Dividing by } \sin. Z, \text{ putting } \frac{1}{\csc.} \text{ for } \frac{1}{\sin.}; \text{ and } \cot. \text{ for } \frac{\cos.}{\sin.}; \cot. X = \csc. Z \tan. l \cos. a - \cot. Z \sin. a.$$

(17.) The first rule given Art. 219 of 'Naut. Astronomy' is the application of formulæ 2 in App. 16, the mer. zenith distance or M. Z. being put for $l - d$ (see App. 14). The second rule is proved thus:—

By formulæ 2, App. 16, *vers. $\theta = \cos. l \cos. d$ vers. P.* to Rad. = 1, or, *vers. $\theta = \cos. a \cos. d$ hav. P.*

Consequently, *vers. $\theta = \cos. l \cos. d$ hav. P* $\times 1000000$ to rad. 1000000, Hence *vers. θ* = nat. number of $\{ \log. \cos. l + \log. \cos. d. + \log. 2 \text{ (or, } 0.301030) + \log. \text{hav. P} + \log. 1000000 \text{ (or } 6.000000) - 30 \}$ = nat. number of $\{ \log. \cos. l + \log. \cos. d + 6.301030 + \log. \cos. l - 30 \}$.

This nat. number being taken from the tables, it will be the *vers. θ* in the 'Naut. Tables,' where radius is 1000000. Then from formula 2 App. 16, *vers. $(l - d) = vers. z$* = nat. number, where $l - d$ is mer. zen. dist. or M. Z.

The declination used in the rule is the declination taken from the Naut. Almanac for the time of observation, and not for the time of meridian passage: the value of M. Z. computed being that which the heavenly body would have, supposing no change to take place in its declination after the observation up to its meridian passage.

There may be an error in the computed latitude on two accounts. The latitude by account used in the operation may be erroneous, and also the estimated hour angle. To give some idea of the greatest probable error in the resulting latitude, let x , l , and P , be the mer. zen. dist. or M. Z. or $l - d$, the latitude, and the hour angle; and let x' , l' , and P' , be small variations in them. Then by differentiating the equation,

$$\text{vers. } x = \text{vers. } z - \cos. l \cos. d \text{ vers. P (see App. 16. 1)}$$

we get nearly $x' \sin. x = l' \sin. l \cos. d \text{ vers. P} - P' \cos. P \cos. l \cos. d.$

(If l' and P' negative) = $-l' \sin. l \cos. d \text{ vers. P} + P' \sin. P \cos. l \cos. d.$

(If l' pos. and P' neg.) = $+l' \sin. l \cos. d \text{ vers. P} + P' \sin. P \cos. l \cos. d.$

(If l' neg. and P' pos.) = $-l' \sin. l \cos. d \text{ vers. P} - P' \sin. P \cos. l \cos. d.$

To investigate general limits for the seaman's guidance, it is proper to take the case where $x' \sin. x$ = the sum of the parts on the right-hand side. Then putting z for x on the right-hand side, as the observation is supposed to be made near the meridian, and therefore x and z nearly equal, we have—

$$x' = l' \frac{\sin. l \cos. d \text{ vers. P}}{\sin. z} + P' \frac{\sin. P \cos. l \cos. d.}{\sin. z} \text{ nearly.}$$

$$\text{But } \frac{\cos. d}{\sin. z} = \frac{\sin. azimuth}{\sin. P.}$$

$$\text{wherefore } x' = l' \frac{\sin. l \sin. az. \text{ vers. P}}{\sin. P.} + P' \cos. l. \sin. az.$$

$$= l' \frac{\sin. l. \sin. az. 2 \sin. \frac{1}{2} P^2}{\sin. P.} + P' \cos. l. \sin. az.$$

$$\left(\text{Putting } \frac{\frac{1}{2} P}{P} \text{ for } \frac{\sin. \frac{1}{2} P}{\sin. P} \right), = l' \sin. l. \sin. az. \sin. \frac{1}{2} P + P' \cos. l. \sin. az. \text{ nearly.}$$

The first member of this expression for x' , namely, $l' \sin. l \sin. az. \sin. \frac{1}{2} P$ must be very small compared with l' , since both P and $az.$ are supposed to be small, and l may be considered as always less than 80° . If P be supposed = 2 hours, $az. = 2$ points or $22^\circ 30'$, $l = 80^\circ$, which is an extreme supposition altogether, the error from the first member of the above expression will scarcely be more than $1'$ after a second operation of the process directed in the rule, in any probable case.

The second member of the expression for x' is, therefore, the only one it is necessary to consider in finding the probable error of a resulting latitude. The numerical values thereof on certain suppositions may be seen in the following table, the error in the hour angle or in the ship mean time being taken *one minute* of time.

Error in Hour Angle 1 ^m .			
Lat.	Azimuth. 1 Point.		Azimuth. 2 Points.
0	2	56	5 44
20	2	45	5 23
40	2	14	4 24
60	1	25	2 52
80	0	30	0 55

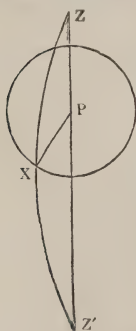
If the error in hour angle or ship mean time be supposed greater than 1^m, the numbers expressing the value of resulting error in latitude must be increased in the same proportion. Thus, if it be considered 2^m, 3^m, 4^m, &c., multiply them by 2, 3, 4, &c.

If the azimuth be less than in the table, the numbers must be diminished in the same proportion.

By inspecting the above table it will be seen that no error of practical importance in navigating a ship need be apprehended, provided the error in hour angle be not more than 2 or 3 minutes; provided also that the azimuth or true bearing from the meridian (to be got by correcting the compass-bearing for variation) be not much greater than 1 point. The same holds true when the azimuth is not much greater than 1½ points, if the latitude be upwards of 40°. But the seaman will easily see how far he can trust to the latitude got by the rule, by applying the circumstances of any case that may occur to the above table, and so getting the amount of the probable error.

The observed altitude, and therefore the true zenith distance, deduced therefrom, has been supposed to be correct. But it frequently happens at sea, especially in cloudy weather (when this method of finding the latitude is more particularly called for), that there may be a considerable error in the observed altitude. Such error to the extent supposed possible may be added to the error given by the table. The sum will be the greatest error to be apprehended in the resulting latitude.

If this method of finding the latitude can be applied to altitudes observed on each side of the meridian at equal azimuths, or nearly so, in that case a mean of the results must be very nearly correct, supposing the observations to be good. For the same error being supposed in the ship mean time and of the same kind in both cases, the error in the hour angle or P' being + on one side of the meridian, it will be - on the other. Consequently the two meridian zenith distances computed will be affected equally different ways, and a mean thereof nearly right.



(18.) In this case the heavenly body is referred to the *nadir* instead of the *zenith*, and the result is the meridian nadir distance of the body, which is equal to its distance from the horizon + distance of nadir from the horizon, that is, to *mer. alt.* + 90°; and *mer. alt.* + 90° - *decl.* = *lat.* (See App. 15.)

Let Z' be the nadir, Z the zenith; then $ZZ' = 180^\circ$, and $ZXZ' = 180^\circ$, X being the body near the meridian under the pole. Let P = hour angle which the body is W . from the upper part of the meridian, that is, the angle ZPX , and P' = the hour angle which X is from the lower part of the meridian or angle $Z'PX$; then $P' = 12^h - P$ or $P - 12^h$. Let z' = nadir dist. or $Z'X$; z = zen. dist. or ZX : then $z' = 180^\circ - z = 90^\circ + (90^\circ - z) = 90^\circ + \text{alt.}$ Let M', Z' denote mer. nadir dist.; then $M', Z' = 90^\circ + \text{mer. alt.}$; also $PZ' = 180^\circ - PZ$. In this case by App. 16, 2.

For log. tables ... *hav.* $\theta = \cos. l + \cos. d + \text{hav. } P' - 20 = \cos. l + \cos. d + \text{hav. } (12^h - P) - 20$. And in nat. versines ... *vers.* $M', Z' = \text{vers. } z' - \text{vers. } \theta$; or *vers.* $(90^\circ + \text{mer. alt.}) = \text{vers. } (90^\circ + \text{alt.}) - \text{vers. } \theta$.

(19.) Assuming different hour angles as 0^h 10^m, 0^h 20^m, &c.; and different latitudes, as 30°, 50°, 70°; with these and the apparent declination of the pole star for the beginning of any year, as 1840, 1850, &c., the true zen. dist. of the star is computed, the difference between which and the colatitude is the correction inserted in Naut. Table, p. 10. From App. 16, 1 we have—

For log. tables . . . *hav.* $\theta = \cos. \text{ lat.} + \cos. \text{ decl.} + \text{hav. hour angle} - 20$. . . (1)
 In nat. versines . . . *vers.* $\text{zen. dist.} = \text{vers.} (\text{lat.} - \text{decl.}) + \text{vers. } \theta$. . . (2)

Where in (1) $\cos. \text{ lat.} + \cos. \text{ decl.}$ may be considered as a constant number for given latitude and beginning of given year. And in (2) *vers.* ($\text{lat.} - \text{decl.}$) may be considered also as a constant number. The R. A. and decl. of the pole star for the beginning of the years 1850 and 1860 are as follows: for 1850, R. A. = $1^{\text{h}} 5^{\text{m}} 0^{\text{s}}.29$; decl. = $88^{\circ} 30' 35''$.40 N.; for 1860, R. A. = $1^{\text{h}} 8^{\text{m}} 1^{\text{s}}.73$; decl. = $88^{\circ} 33' 47''$.64 N.

(20.) Let X be the true place of the heavenly body at the first observation, and Z the zenith. Then, whatever arc the ship describes on the surface of the sea in the interval between the observations, the zenith Z will describe a similar arc containing the same number of minutes on the celestial concave, and in the same direction as to N. and S. Let ZZ' be this arc, and let Z'D be a parallel round pole X, and therefore ZD the necessary correction of ZX in order to reduce it to the second zenith Z'. Now the angle DZZ' is the angle between the course of the zenith or the ship and the bearing of X on the vertical circle ZX. And ZD must be nearly the *diff. lat.* corresponding to ZZ' as a *dist.* and angle DZZ' as a *course* (see 'Navigation,' Art. 10, 11). When DZZ' is less than 90° or 8 points, ZX will be less than ZX, and consequently ZD *subtractive* from ZX, or *additive* to the first altitude observed. When DZZ' is greater than 90° or 8 points, the correction will be *subtractive* from the first altitude observed.

This correction may also be found by considering ZZ'D as a right-angled spherical triangle. Add together log. *tan.* of ship's run and log. *cos.* of angle between bearing of body and ship's course (both by compass or both not), rejecting 10 in the index of sum. The result will be the log. *tan.* of correction in ' and ''.



(21.) The rule for finding arc (1) is immediately derived from the general formula (a) in App. 16, the polar angle XPY (fig. in 'Naut. Astronomy,' p. 103) being put for angle A, and polar distances PX and PY for sides *b* and *c*, the arc (a) for θ , and XY or arc (1) for side *a*.

The rule for finding arc (2) is derived from the general formula (γ) in App. 16, the angle PXY or (2) ('Naut. Astronomy,' p. 103) being put for A, PY for the side *a*, and PX and XY for the sides *b* and *c*.

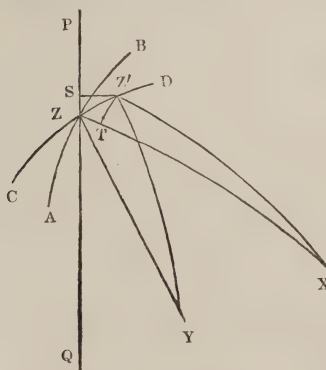
The *third* operation is similar to the *second*, and the *fourth* to the *first*. In the third the three sides XY, ZX, and ZY, are given to find the angle ZXY, the difference or the sum of which and PXY is the angle PXZ. Whether the difference or the sum is to be taken, may generally be determined as directed in p. 107 of 'Naut. Astron.,' in note †; otherwise the value of (*b*) (see rule) must be computed, by assuming the colatitude PZ as known nearly; from which, and the two other sides PX and ZX, the angle PXZ is computed by the method of the *second* operation. The result will be correct enough to determine whether the difference or the sum of PXY and ZXY, denoted in rule by (2) and (3), is to be used. In the *fourth* operation the sides PX and ZX, with the included angle PXZ, are given to find the true colatitude PZ, which being subtracted from 90° , the result is the latitude.

(22.) When the observer is near the terrestrial equator, it is possible that he may assume the latitude by account of a wrong name, that is, he may consider himself in S. latitude when he is really in N. latitude, or *vice versa*. In such a case the colatitude computed by the rule will come out greater than 90° , and the true latitude will be the excess above 90° of a different name to the supposed latitude by account. For in such a case the rule will give the distance of the true zenith from the pole supposed elevated above the horizon, but actually depressed below it.—It may be further noticed, as worthy of the seaman's attention, that the observer in the supposed case will imagine the arc between the two places of the heavenly body or bodies observed to pass *between* his zenith and the supposed pole, when it actually passes on the same side of his zenith and the true elevated pole, and *vice versa*; so that he will, in following the directions in the rule, use the *sum* of the arcs (2) and (3) instead of their *difference*, and the *difference* instead of the *sum*. In fact he will work throughout for the depressed pole, the distance of which from the zenith is $90^{\circ} +$ the distance of that pole under the horizon, or $90^{\circ} +$ *true latitude*.

(23.) The propriety of the limits given in 'Nautical Astronomy,' Art. 226, may be shown as follows:—

1. Error in Latitude occasioned by an Error in observed Altitude.

Let PZQ be the celestial meridian, P the pole, Z the true zenith, X the true place of the body observed at the *greater* bearing XZQ , Y the true place of the body observed at the *less* bearing $YZQ =$ (suppose) b ; and let AZB , CZD , be parallels round poles X and Y . Instead of the true zenith distance ZX , let an incorrect one equal to $Z'X$ be used in the computation by the rule for finding the latitude. Then, if the zenith distance ZY be supposed to remain correct, it is evident, since $Z'Y$ is equal to ZY , that by the said computation the point Z' will be determined for the zenith instead of Z the real zenith; so that, if $Z'T$, $Z'S$, be parallels round the poles X and P , ZT will be the error in zenith distance of X and ZS the corresponding error in the colatitude, that is, $PS = PZ'$ will be determined for the colatitude, instead of PZ .



Now $ZS = ZZ' \cos. Z'ZS$, and $ZZ' = \frac{ZT}{\cos. Z'ZT}$; consequently $ZS = ZT \cdot \frac{\cos. Z'ZS}{\cos. Z'ZT}$, where $Z'ZS$ or CZQ is the complement of YZQ , the less bearing, that is, of b ; and $Z'ZT$ is the complement of XZY , the difference of the bearings, that is, of d , if d denote that difference. It appears therefore that :

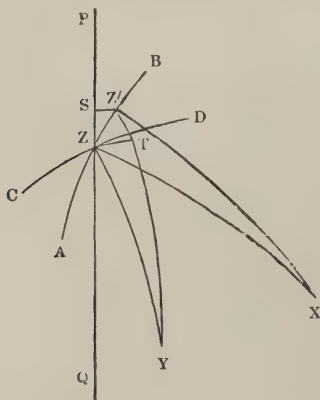
$$\text{Error in lat.} = \text{error in alt.} \frac{\sin. b}{\sin. d}$$

Since, according to rule in Art. 240, 'Naut. Astron.', b must be always less than d and also less than $180^\circ - d$, it follows that $\sin. b$ is always less than $\sin. d$. Consequently $\frac{\sin. b}{\sin. d}$ is always less than

1. If, therefore, the error in altitude at the greater bearing be $2'$, which is the utmost that should be made at sea, the consequent error in the computed latitude will be less than $2'$, supposing the observation at the less bearing to be correct.

If $\sin. b$ be less than one-half, one-third, &c., of $\sin. d$, then the error in the computed latitude arising from an error in the altitude at the greater bearing considered singly will be less than one-half, one-third, &c. of $2'$, or than $1'$, $40''$, $30''$, &c.

Let the error be now supposed to be in the zenith distance at the *less* bearing (consequent on an error in the observed altitude), and let the zenith distance at the *greater* bearing be supposed correct. Thus, instead of ZY let $Z'Y$ be got from observation. Then since $Z'X = ZX$, it is evident that Z' will be the zenith determined by the computation, and that $Z'T$ and ZS will be corresponding errors in the zenith distance at the less bearing and in the colatitude, Y and P being poles of ZT and $Z'S$.



Now, $ZS = ZZ' \cos. Z'ZS$, and $ZZ' = \frac{Z'T}{\sin. Z'ZT}$; consequently, $ZS = Z'T \cdot \frac{\cos. Z'ZS}{\sin. Z'ZT}$, where $Z'ZS$ or AZQ is the complement of the greater bearing XZQ , that is, of $b+d$; and $Z'ZT = XZY = d$, each having the same complement XZT . Hence it appears that :

$$\text{Error in lat.} = \text{error in alt.} \frac{\sin. (b+d)}{\sin. d}$$

Now, since $\sin. (b+d)$ is less than $\sin. b + \sin. d$, it follows that $\frac{\sin. (b+d)}{\sin. d}$ is less than $\frac{\sin. b + \sin. d}{\sin. d}$

or $\frac{\sin. b}{\sin. d} + 1$. And since $\frac{\sin. b}{\sin. d}$ has been shown above to be less than 1, it follows that $\frac{\sin. (b+d)}{\sin. d}$

is less than 2. So that supposing the error in the zenith distance (or in the observed altitude) at the

less bearing to be $2'$, the other altitude being correct, the consequent error in the computed latitude will be less than $2 \times 2'$, or $4'$.

If $\sin. b$ be much less than $\sin. d$, as one-half, one-third, &c., thereof, this error will be considerably less than $4'$.

If errors be made in both altitudes, as of $2'$ in each, and these errors concur in their effects on the computed latitude, then the whole error in the said latitude will be less than $2' + 4'$, or $6'$.

2. Error in Latitude occasioned by an Error in the Polar Angle.

Let X be the true place of the body observed at the *greater bearing*, and Y the true place of the body observed at the *less bearing*. Then XPY is the correct polar angle. Let $X'PY$ be the polar angle used in the computation for the latitude, and consequently XPX' the error in polar angle. Let XX' , $X'T$, be parallels round poles P and Z . Then, if the computation were made with zenith distance ZX' or ZT instead of ZX , the true zenith Z would be determined, and therefore the true latitude. That is, an error XT in the zenith distance will just cancel the error arising from XPX' ; and consequently, in effect, have the same amount. Now,

$$\begin{aligned} \text{Error from } XT = XT. \frac{\sin. b}{\sin. d} &= XX' \cos. X'T \frac{\sin. b}{\sin. d} = XPX' \sin. PX \sin. ZXP. \frac{\sin. b}{\sin. d} \\ &= XPX' \sin. PZX \sin. PZ. \frac{\sin. b}{\sin. d} \\ &= XPX' \sin. XZQ \sin. PZ. \frac{\sin. b}{\sin. d} \\ &= XPX' \sin. PZ. \frac{\sin. (b+d) \sin. b}{\sin. d} \end{aligned}$$

$$\text{Hence, Error in lat.} = \text{error in pol. angle} \cos. \text{lat.} \frac{\sin. (b+d) \sin. b}{\sin. d}$$

Now, $\frac{\sin. b}{\sin. d}$ has been shown to be less than 1, and $\sin. (b+d)$ cannot exceed 1; consequently the error in latitude can never be as great as the error in polar angle in arc, and generally must be a small fraction thereof.

The same expression would have been got for the error in latitude, if the error in polar angle had been placed at the less bearing.

Hence, if we suppose an error of 10 seconds in time, or $2' 30''$ in arc, to take place in the polar angle, the error in latitude arising therefrom will always be less than $2' 30''$.

From the above remarks we may conclude, that, if the sources of error specified above concurred in their effect on the computed latitude, the observer with common care need not apprehend a greater error on the whole in the latitude than about $7'$ or $8'$; provided he attend to the limits pointed out in 'Naut. Astronomy,' Art. 226. The error in general will be much less.

(24.) The following methods of computing the latitude from altitudes observed near the meridian, that is, when the heavenly body bears nearly N. or S., may tend to give the seaman a little practice in such computations.

RULE.—When the hour angle and latitude by account are given: Under two heads marked (1) and (2) write down as follows:—Under (1) write 5.615455 , and under (2) write 4.384545 . Again, under (1) write $\log. \text{hav. hour angle}$, $\log. \text{cosec. true zen. dist.}$, and at the same time under (2) write $\log. \text{cot. true zen. dist.}$. Under (1) $\log. \cos. \text{decl.}$. Add the numbers under (1) and mark the sum S ; also the numbers under (2) and mark the sum S' . Under S write $\log. \cos. \text{lat. by account}$, and add it to S , rejecting the tens from the index of sum. Write the result *twice* under S' , and add, rejecting the tens from the index of sum. Take from the tables the *nat. numbers* corresponding to the two resulting logarithms, and add them together. The sum will be the correction in seconds, to be subtracted (when reduced to $0''$) from the true zen. dist. The remainder will be the *mer. zen. dist.* from which and the *decl.* (at the time of observation) the latitude may be easily got. (See Art. 211 of Naut. Astronomy, and App. p. 254, note*.)

If the resulting latitude differ materially from the lat. by account, repeat the operation as follows. Write down S , and under it put the $\log. \cos.$ of the *first resulting lat.*,

and add it to S , rejecting the tens from the index of the sum. Then under the S' write again the result *twice*, adding as before, and rejecting the tens from the index of the sum. Proceed with the resulting logarithms as before. And, if necessary, go on to a third operation.

Ex. Lat. by acc. = $50^{\circ} 30' N.$; decl. = $16^{\circ} 10' 14'' N.$; true zen. dist. = $68^{\circ} 5' 27''$; hour angle = $56^m 10^s$.

First Operation.	
(1)	(2)
5.615455	4.384545
8.174357	9.604588
10.032554	
9.982505	13.989133 S'
	3.608381
S 33.804871	3.608381
9.803510	
	1.205895
3.608381	
4058.6	16.1
16.1	
4074.7 = $\overset{\circ}{1} \overset{'}{7} 54.7$	
	68 5 27
M.Z. 66 57 32.3 N.	
Decl. 16 10 14.0 S.	
Lat. 50 47 18.3 N.	

Second Operation.	
(1)	(2)
S 33.804871	13.989133 S'
9.800844	3.605715
	3.605715
	1.200563
4033.8	
15.9	15.9
4049.7 = $\overset{\circ}{1} \overset{'}{7} 29.7$	
	68 5 27.3
M. Z. 66 57 57.6 N.	
Decl. 16 10 14.0 S.	
Lat. 50 47 43.6 N.	
Third Operation 50 47 44.2 N.	

The above rule may be proved as follows. Let z = true zen. dist. from observation, $z - z' = \text{mer. zen. dist.}$; and let $\theta = 2 \text{ hav. } P \cos. d \cos. l$, or θ'' (θ in seconds) = $\frac{2}{\sin. 1''}$

$\text{hav. } P \cos. d \cos. l$, and $\log. \theta'' = \log. 2 - \log. \sin. 1'' + \log. \text{hav. } P + \log. \cos. d + \log. \cos. l - 20 = \log. 2 + \text{ar. co. log. sin. } 1'' + \log. \text{hav. } P + \log. \cos. d + \log. \cos. l - 30 = 5.615455 + \log. \text{hav. } P + \log. \cos. d + \log. \cos. l - 30$. Hence $\log. (\theta'' \text{ cosec. } z) = 5.615455 + \log. \text{hav. } P + \log. \text{cosec. } z + \log. \cos. d + \log. \cos. l - 40 = S + \log. \cos. l - 40$ (see rule). Now by App. 16. 1, $\text{vers. } z - \text{vers. } (z - z') = \theta$, or $\cos. (z - z') - \cos. z = \theta$,

that is, expanding $\cos. (z - z')$, $\cos. z + \sin. z \cdot \frac{z'}{1} - \cos. z \cdot \frac{z'^2}{1.2} - \&c. \dots - \cos. z = \theta$,

or $z' \sin. z - z'^2 \frac{\cos. z}{2} = \theta$, neglecting the third term $- z'^3 \frac{\sin. z}{6} \dots$. Hence, $z' =$

$\frac{\theta}{\sin. z} + z'^2 \frac{\cot. z}{2} = \theta \text{ cosec. } z + z'^2 \frac{\cot. z}{2}$, and $z' = (\text{nearly}) \theta \text{ cosec. } z$. Consequently,

substituting $\theta \text{ cosec. } z$ for z' in the second term, $z' = \theta \text{ cosec. } z + (\theta \text{ cosec. } z)^2 \frac{\cot. z}{2}$, and

z' in seconds = $\theta'' \text{ cosec. } z + (\theta'' \text{ cosec. } z)^2 \frac{\sin. 1'' \cot. z}{2} = (\text{suppose}) \alpha'' + \beta''$. Then

$\log. \alpha'' = S + \log. \cos. l - 40$, and $\log. \beta'' = \log. \sin. 1'' - \log. 2 + \log. \cot. z + 2 \log. \alpha'' - 20 = 4.384545 + \log. \cot. z + 2 \log. \alpha'' - 20 = S' + 2 \log. \alpha'' - 20$; which two equations give the rule.

If an additional term in the expansion of $\cos. (z - z')$ be taken in, the following additional term will be found in the value of z' in seconds, namely, $(\theta'' \text{ cosec. } z)^3 \frac{\sin. 1''^3}{6}$. To compute this: to 8.592999 add three times $\log. \alpha''$, rejecting tens in

index of sum (see App. p. 254, note *): The result will be $\log.$ of seconds to be added. In the foregoing example this addition would be $0''.26$.

(25.) To find the latitude from two altitudes near the meridian, and the corresponding hour angles, without the latitude by account.

RULE.—Write down the hour angles and their *nat. versines* (taken from Naut. Tables,

p. 245 to 247), of which *nat. versines* take the difference and mark it *a*; also the corresponding true zen. distances and their *nat. versines*, of which take the difference and mark it *b*. Add together ar. co. log. *a*, log. *b*, and log. of *versine* of hour angle nearest meridian, rejecting the tens from the index of the sum. Find the *nat. number* corresponding to the resulting logarithm, and subtract it from the *nat. versine* of true zen. dist. at less hour angle. The remainder will be the *nat. versine* of the mer. zen. distance, from which and the decl. of the body find the latitude (Art. 211 of Naut. Astronomy).

H. Angles.	Nat. Vers.	Tr. Zen. Dist.	Nat. Vers.		
m. sec.					
Ex. ... 8 34.9 ...	701	67 34 10.2	0618438	7.361514	
5 16.9 ...	266	67 33 18.4	0618206	2.365488	
				2.424882	
	435 <i>a</i>		232 <i>b</i>	2.151884	... 141.9
				0618206.0	
			M. Z. N. 67 32 46.8		0618064.1
			Decl. S. 16 44 37.0		
			Lat. 50 48 10.2 N.		

The proof of the above rule is as follows. Let v' , v'' be the *nat. versines* of the two hour angles, V' , V'' the *nat. versines* of the corresponding true zen. distances, and let V be the *nat. versine* of the mer. zen. dist. Then, since *vers. zen. dist. — vers. M. Z.* varies as *vers. P* (App. 16. 1)

$$v' : v'' :: V'' - V : V' - V, \text{ and } v'' : v' :: V'' - V : V'' - V$$

$$\text{Hence, } V'' - V = \frac{(V'' - V') v''}{v'' - v'}$$

And log. $(V'' - V) = \text{ar. co. log. } (v'' - v') + \log. (V'' - V') + \log. v'' - 10.$

Subtracting $V'' - V$ from V'' , the remainder is V the mer. zen. dist.

NOTE.—The difference of hour angles should not be much less than the less hour angle. When the observations are taken on different sides of the meridian at nearly equal hour angles, the most accurate result may be expected. The rule supposes the declination not to change in the interval as for a star. When it does change, it may be taken for the middle time.

(26.) To find the latitude from three altitudes near the meridian and on the same side thereof, and the corresponding times by *chronometer*, without the latitude by account or the hour angles.

RULE.—Write down the time by *chronometer* at the farthest observation from the meridian, and opposite thereto the corresponding true zen. distance; immediately under, the time next in distance from the meridian with the corresponding true zen. distance, and then the time nearest to the meridian and the corresponding true zen. distance.

Take the differences of the times written down between the first and second, and between the first and third. In these differences let the seconds be expressed in decimals of minutes,* and mark the results *a* and *b*.

Take from the tables the *nat. versines* of the true zen. distances, of which take the differences between the first and second, and first and third, marking them *c* and *d*.

Add the logarithms of *a* and *d*, and mark the sum *e*; also add the logarithms of *b* and *c*, and mark the sum *f*. Again to *e* add the logarithm of *a*, and mark the sum *g*; also to *f* add the logarithm of *b*, and mark the sum *h*.

Find *nat. numbers* to *e* and *f*, and take their difference; also *nat. numbers* to *g* and *h*, and take their difference. Lastly, take out the logarithms of these differences, and take their difference. Then half the *nat. number* of this last difference (continued at least to two places of decimal fractions) will be the *hour angle* in minutes and decimals of minutes corresponding to the first true zen. distance written down. Turn the decimals of minutes into seconds of time.†

From the computed hour angle subtract the greatest difference of the times put down above, and the remainder will be the *hour angle*, corresponding to the last true zen. dist.

* Dividing the seconds by 60.

† Multiplying the decimal fractions of minutes by 60.

written down. Proceed then with the two hour angles and two corresponding zenitha distances to compute the latitude by the last rule.

Chronometer.		Tr. Zen. Dist.		Nat. Vers.	
h. m. sec.					
<i>Ex.</i> 0 21 11.8	m. sec.	67 41	9.5	..	0620317
0 14 17.9	.. 6 53.9	6 900 <i>a</i>	67 36 18.8	..	0619014 .. 1303 <i>c</i>
0 9 59.8	.. 11 12.0	.. 11.200 <i>b</i>	67 34 19.7	..	0618480 .. 1837 <i>d</i>
0.838849	1.049218	12675.3	87460.0		
3.264109	3.114944	14593.6	163448.1		
<i>e</i> 4.102958	4.164162 <i>f</i>	1918.3	75988.1		
0.838849	1.049218	3.282917	4.880746		
			3.282917		
<i>g</i> 4.941807	5.213380 <i>h</i>	<i>m</i>			
		2) 39.612	.. 1.597829		
		19.806	= 19 48.4		
			11 12.0		
			8 36.4		
Hour Angles.		Tr. Zen. Dist.		Nat. Vers.	
m. sec.					
19 48.4	3732.4	67 34 10.2	0620317	6.518959	
8 36.4	705.2	67 34 19.7	0618480	3.264109	
				2.848312	
<i>a</i> 3027.2			1837 <i>b</i>		
				2.631380	
				427.9	
				0618480.0	
		M. Z. N. 67 32 44.3			
		Decl. S. 16 44 37.0			0618052.1
		Lat. 50 48 7.3 N.			

The proof of the above rule is as follows: Let $P, P-t', P-t''$, be the *hour angles* in time; V', V'', V''' , the *nat. versines* of the corresponding true zen. distances; and V the *nat. versine* of the mer. zen. distance. Then, since increments of *nat. versines* of true zen. distances from meridian are proportional to *nat. versines* of hour angles (App. 16), which are proportional to \sin^2 of half thereof, and, therefore, for small angles are very nearly proportional to the squares of the angles, we have

$$\begin{aligned}
 & V' - V : V'' - V :: P^2 : (P - t')^2, \text{ and therefore,} \\
 & V' - V : V' - V'' :: P^2 : P^2 - (P - t')^2 :: P^2 : 2 P t' - t'^2; \\
 & \text{Hence, } \frac{2 P t' - t'^2}{V' - V} = \frac{P^2}{V' - V}; \text{ in like manner } \frac{2 P t'' - t''^2}{V' - V''} = \frac{P^2}{V' - V''}. \\
 & \text{Therefore, if } V' - V'' = d', \text{ and } V' - V''' = d'', \\
 & \frac{2 P t' - t'^2}{d'} = \frac{2 P t'' - t''^2}{d''}; \text{ and } 2 P (t' d'' - t'' d') = t'^2 d'' - t''^2 d'; \\
 & \text{Hence, } 2 P = \frac{t'^2 d'' - t''^2 d'}{t' d'' - t'' d'}.
 \end{aligned}$$

which in logarithms gives the rule.

(27.) In putting in practice the above rule, care must be taken that the intervals between the times bear a considerable proportion (if not equal) to the interval between the observation nearest to the meridian and the time of the meridian passage as estimated nearly. At sea it is not unusual to take and write down several altitudes with the corresponding times by chronometer a little before the meridian passage or a little after in which case those observations may be selected from the whole for the application of the above rules which seem to be sufficiently distant from each other. Should the meridian altitude be also got, the seaman will have an opportunity of ascertaining how far he can depend on the result of any of the above rules; if not, it will then be necessary to compute the latitude either by the rule for double altitude, Art. 225 of 'Naut. Astronomy,' or by the

rule in Art. 215, or by one of the last rules. He may, indeed, by way of profitable practice, use all these methods, whereby he would acquire facility and confidence in determining the latitude of the ship by different methods.

The above rule supposes no change to take place in the declination of the body observed, as for a fixed star. When such change does occur, as for the sun, moon, or a planet, the declination may be found for the middle time of the observations, that is, for a Greenwich date corresponding to this.

(28.) Here P, Z, X, (fig. 'Nautical Astronomy,' p. 44), being the celestial pole, the zenith, and the heavenly body, the three sides PX, PZ, and ZX, are known, and it is required to compute the hour angle ZPX in time. The rule is at once derived from the logarithmic formula, App. 16. 4.

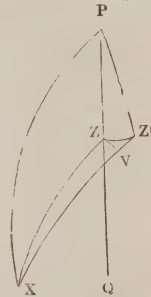
(29.) *Error in Hour Angle occasioned by a small error in Altitude.*

Let ZZ' and ZV be parallels round poles P and X; ZPZ' and Z'V corresponding small variations of hour angle P and of zenith distance ZX.

$$\text{Then } ZPZ' = \frac{ZZ'}{\sin. PZ} = \frac{Z'V}{\sin. Z'ZV \sin. PZ} = \frac{Z'V}{\sin. QZX \sin. PZ}.$$

$$\text{Hence, error in hour angle} = \text{error in alt.} \frac{1}{\sin. \text{az.} \cos. \text{lat.}} = \text{error in alt. cosec. az. sec. lat.}$$

In lat. 50° , at azimuth 2 points or $22^\circ 30'$, if the error in altitude were 2', the error in hour angle would be $41''.6$, and consequently the error in the longitude of the ship would be $10' 24''$: at azimuth 4 points or 45° these errors would be $17''.6$ and $4' 24''$: at azimuth 8 points or 90° these errors would be $12''.4$ and $3' 6''$. Generally these errors must be the least for any given latitude and error in altitude, when the azimuth of the body is 8 points or 90° ; that is, when the body bears due east or due west.



(30.) *Error in Hour Angle occasioned by a small error in the Latitude.*

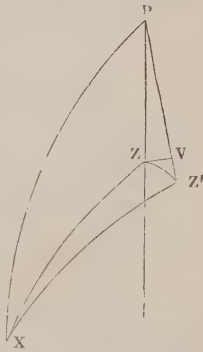
Let ZPZ' and Z'V be corresponding small variations in hour angle P and colatitude PZ; ZZ' and ZV being parallels round poles X and P. Then

$$ZPZ' = \frac{ZV}{\sin. PZ} = \frac{Z'V}{\tan. Z'ZV \sin. PZ} = \frac{Z'V}{\tan. QZX \sin. PZ}.$$

$$\text{Hence, error in hour angle} = \text{error in lat.} \frac{1}{\tan. \text{az.} \cos. \text{lat.}} = \text{error in lat. cot. az. sec. lat.}$$

In the cases specified above, the error in hour angle would be, in the first case, $32''$, and the error in the longitude of the ship $8'$; in the second case, these errors would be $12''$ and $3'$; in the third case, they would be 0.

It appears, therefore, that the most advantageous position of a heavenly body, from the altitude of which the longitude of the ship is to be deduced, is when it bears due east or due west; supposing an error possible in either the latitude to be used in the computation or in the altitude observed. At all events, when such errors are suspected, to any extent, the azimuth of the body should not be less than 3 or 4 points.



(31.) Supposing the same error to be made in the observed altitude, or to exist in the latitude, both at the observation east of the meridian and at that west thereof, then, if one hour angle be made too small thereby, the other will be made too small also. But too small an hour angle east of meridian makes ship time too far advanced, that is, too great; and too small an hour angle west of meridian makes ship time too little advanced, that is, too little. So that the errors produced in the longitude must be of different kinds, and tend to correct one another. The same thing is manifestly true, supposing the error in each hour angle to be in excess.

Such a correction of error must be most exact when the altitudes are observed east

and *west* of the meridian nearly at equal bearings of the bodies, and as nearly as possible (as for different stars) at the same time.

(32.) Let a heavenly body be observed at *X* (see figure subjoined) east of meridian, and at *Y* west of meridian, the zenith distances being supposed equal. In the interval let the body have had a small motion in declination so as to increase its distance from the elevated pole *P*, or to diminish its declination, which declination is first considered as having the same name with the latitude. Then, if *XYV* be a parallel round pole *Z*, *PY*, being greater than *PX*, must make a less angle at *P* with the meridian than *PX* does; that is, the angle *ZPX* must be greater than *ZPY*. Half their sum is, therefore, less than the greater by half their difference.

Let *PY'*, an arc west of meridian, be supposed to be equal to *PX*; then it is evident that the angle *ZPY' = ZPX*, and that the difference between *ZPX* and *ZPY* is *YPY'*, half of which is what half *XPY* is less than *ZPX*, the hour angle east of meridian. Hence, if the angle *XPY* be correctly measured in time by a chronometer going with the body, half the whole interval so measured will be less than the interval from *X* to the meridian passage by half the angle *YPY'* measured by the same chronometer.

Let *Y'V* be a parallel round *P*: then,

$$YPY' = \frac{Y'V}{\sin. PY'} = \frac{YV \cot. VY'Y}{\sin. PY'} = \frac{YV \cot. ZY'P}{\sin. PY'} = \frac{YV \cot. ZXP}{\cos. \text{decl. of } X}.$$

For *VY'Y = ZY'P*, *ZY'V* being the complement of each; and *ZY'P = ZXP*, the triangles *ZPY'* and *ZPX* being equal in every respect. But by App. 16. 8, if *l = lat.*, *d = decl.*, and *P = hour angle*,

$$\cot. X = \frac{\cos. d}{\sin. P \cot. l} - \frac{\sin. d}{\tan. P}; \text{ hence } YPY' = YV.$$

$$\left(\frac{1}{\sin. P \cot. l} - \frac{1}{\tan. P \cot. d} \right). \text{ And } \frac{\frac{1}{2} YPY'}{15} = \frac{1}{30}$$

$$YV. \frac{1}{\sin. P \cot. l} - \frac{1}{30} YV. \frac{1}{\tan. P \cot. d} = (\text{suppose})$$

$$\alpha + \beta.$$

Then, since *YV = change of decl. in T. Elapsed =*
ch. of decl. in 24^h × $\frac{T. El.}{24^h}$; it follows that $\alpha = \frac{1}{30}$

$$\text{ch. of decl. in } 24^h. \frac{T. El.}{24^h} \cdot \frac{1}{\sin. P \cot. l}, \text{ and } \frac{3^h}{\alpha} = 30. \frac{3^h}{\text{ch. decl. in } 24^h} \cdot \frac{24^h}{T. El.} \cdot \sin. P \cot. l.$$

Or, prop. log. $\alpha = \log. 30$ (or 1.47712) + prop. log. ch. decl. in 24^h + Gr. date log. for *T. El.* + log. *sin. P* + log. *sin. l* - 20. In like manner, prop. log. $\beta = 1.47712$ + prop. log. ch. decl. in 24^h + Gr. date log. for *T. El.* + log. *tan. P* + log. *cot. d* - 20; which two expressions comprise the rule. The result is called the *equation of equal altitudes*.

In the above investigation the latitude and declination have been supposed to have the same name, and the polar distance to increase, so that the change of decl., or *YV*, is considered *positive*. Also the angle *P* is considered as less than 6^h , so that both $\frac{1}{\sin. P \cot. l}$

and $\frac{1}{\tan. P \cot. d}$ are positive (see note to App. 11). In this case, therefore, α is *positive*,

and β is *negative*. Other circumstances remaining the same, let the polar dist. decrease, or the decl. increase, then *YV* must be considered as *negative*, and the signs of α and β will be changed, that is, α will be *negative* and β *positive*. When the declination and latitude have different names, and the declination increases, in that case the polar distance increases, and *YV* is *positive*; and *cot. d* or *tan. polar distance* is *negative* (see note to App. 11); hence, α is *positive*, and β is also *positive*. When in this case the decl. decreases, *YV* is *negative*; consequently α is *negative* and β is also *negative*.

Should the hour angle *P*, that is, half the whole time elapsed, be greater than 6^h , then *tan. P* is *negative*, and the sign of β is contrary to what is stated above. (See rule in 'Naut. Astronomy,' p. 123.)

The chronometer by which the time elapsed is measured has been supposed to go with.

the body, that is, to show correctly the angle in time described by the body round P. Usually the body observed is the sun, and the chronometer (corrected, if necessary, for rate) gives M. T.; the only error in which is the variation in the equation of time in the time elapsed, which variation might be applied as directed in 'Naut. Astronomy,' Art. 229; but this can scarcely ever be required, as the hour angle given by the chronometer will be sufficiently correct for computing the equation of eq. alts. It may be here noticed also that the eq. of eq. alts. is got (see foregoing investigation) by turning half the angle YPY' into time at the rate of 15" to a second of time; whereas this half angle is actually required as shown by the chronometer. However, the difference can scarcely be practically essential.

When a chronometer going according to sidl. time is used, and the body observed is the sun, in such a case the time elapsed may be diminished by the seconds taken from 'Naut. Table' (23), p. 379.

When the body is a fixed star, there is no eq. of eq. alts., as there is no change of decl. The approximate time of the mer. passage as got by the rule ('Naut. Astron.,' Art. 258) is the correct time.

When the body is a planet, the process is similar to that for the sun, taking the change of the planet's decl. instead of the sun's. When the chronometer shows M. T., the time elapsed may be diminished, if thought essential, as pointed out in 'Naut. Astron.,' Art. 231.

By observing equal altitudes with care, and computing and applying the eq. of eq. alts., the error of a chronometer on mean or on sidl. time at the place may be determined with great exactness. There may, however, be one cause of error, not in general, perhaps, sufficiently attended to, which is the difference of refraction there may be at the two observations, east and west of the meridian, from a change in the pressure or temperature of the air. This difference may be ascertained by noting at both times the heights at which the barometer and thermometer stand, and taking out the true refraction, that is, the refraction corrected for barometer and thermometer (see App., p. 246, and 'Naut. Table,' pp. 8 and 379). Thus at the first observation let the true refraction be 100", and at the second 110". Then the altitude which the instrument shows at the first observation is 100" more than the true altitude; and at the second, in order to get the time by chronometer of an equal true altitude, it ought to be set to 110" more than true altitude; whereas it is set as at first, only to 100" more; so that the time noted will be too great by the interval in which the body descends through 10" of altitude. According to the observation, let the body descend through 10' in 30 seconds, or through 10" in $\frac{1}{3}$ second or 0.5 seconds. Then the time elapsed will require diminishing by 0.5 seconds. In like manner, when the true refraction at the second observation is less than at the first, the time elapsed will require increasing. It is here supposed that the body moves from east to west of the meridian. When it passes from west to east, as under the pole, in that case the mode of proceeding is the contrary to what has been just stated.

(33.) In this case the body first descends to the inferior meridian passage, and then ascends, so that the effect of the motion in declination is contrary to what it is stated to be in App. 32; that is, the change in decl. must be considered *negative* when before it was *positive*, and conversely. At the same time it must be noticed that the trigonometrical part of the investigation has a reference to the elevated pole P and the triangles as they stand in figure p. 266; and, consequently, that when the time elapsed through the inferior meridian passage is greater than 12^h, it must be considered as less than 12 hours, and when less as greater. Hence appears the correctness of the precepts given in Art. 260 of 'Naut. Astronomy.'

(34.) Let the true zen. distances ZT and ZR (fig. in Art. 265 of 'Naut. Astron.')

be denoted by z and z' , and the two apparent altitudes, of which ZM and ZS are the complements, by a and a' . Let the true dist. TR be denoted by x , and the app. dist. MS by δ . Then in the triangles ZTR and ZMS, since each of the following expressions is equal to $\cos. Z$ (see App. 16), we have the expressions themselves equal; that is,

$$\frac{\cos. x - \cos. z \cos. z'}{\sin. z \sin. z'} = \frac{\cos. \delta - \sin. a \sin. a'}{\cos. a \cos. a'} : \text{adding 1 to each side, and reducing,}$$

$$\cos. x + \sin. z \sin. z' - \cos. z \cos. z' = \{ \cos. \delta + \cos. a \cos. a' - \sin. a \sin. a' \} \frac{\sin. z \sin. z'}{\cos. a \cos. a'}$$

Putting $-\cos. (z + z')$ for $\sin. z \sin. z' - \cos. z \cos. z'$; and $\cos. (a + a')$ for $\cos. a \cos. a'$

$$- \sin. a \sin. a'; \text{ we have } \cos. x - \cos. (z + z') = \{ \cos. \delta + \cos. (a + a') \} \frac{\sin. z \sin. z'}{\cos. a \cos. a'}$$

Putting $2 \cos. A$ for $\frac{\sin. z \sin. z'}{\cos. a \cos. a'}$ and transposing,

$$\begin{aligned} \cos. x &= \cos. (z + z') + 2 \cos. (a + a') \cos. A + 2 \cos. \delta \cos. A; \text{ or} \\ \cos. x &= \cos. (z + z') + \cos. (a + a' + A) + \cos. (a + a' - A) + \cos. (\delta + A) + \cos. (\delta - A). \end{aligned}$$

Putting $r - vers.$ for $\cos.$, changing signs, &c. we have

$$vers. x = vers. (z + z') + vers. (a + a' + A) + vers. (a + a' - A) + vers. (\delta + A) + vers. (\delta - A) - 4 r.$$

In the table of nat. versines (Naut. Tables) $r = 1000000$; consequently $4r = 4000000$. Hence the rule; observing that the value of A^* is to be taken from Naut. Table (w), and that it is not necessary to take from the table of *nat. versines* more than the *last five* figures; and observing also that all the figures in the sum got except the *last five* may be rejected. These omissions are practicable, since the *nat. vers.* of true distance required is always found in the same column with the *nat. vers.* of app. dist., or in one of the adjacent columns, and since in these three columns the two first figures are the same. By looking therefore for the app. dist., the *nat. versine* of the true dist. is at once found from the *last five figures*.

The rule for finding ship mean time is the same as in Art. 249 of 'Naut. Astronomy.'

(35.) The rule for deducing Greenwich mean time from the true dist. computed supposes that the increase or decrease of dist. is proportional to the time, that is, that the dist. increases or decreases uniformly. Let d = increase or decrease of dist. in the 3^h in which the computed dist. is found in the 'Naut. Almanac,' that is, the difference between the dist. which precedes the computed dist. and that which follows it; and let δ = difference between the computed dist. and that which precedes it in the 'Naut. Almanac.' Then on the supposition just mentioned:

$d : \delta :: 3^h : t$, t being the time of changing the dist. by δ . Consequently $\frac{3^h}{t} = \frac{d}{\delta} = \frac{3^h}{\delta} \div \frac{3^h}{d}$, and prop. log. t = prop. log. δ - prop. log. d ; which is the rule.

The distance, however, does not generally change uniformly, so that there must often be a small error in the result of the above proportion, the proper correction for which may be taken from a table at page 584 in the 'Naut. Almanac.' Supposing d to be the change of distance in the 3^h in which the computed distance lies, and δ that in the succeeding 3^h ; then $d - \delta$ may be considered as the *second difference* in distance for 3^h , and supposing t , as found above, to be expressed in a fraction (denoted by x) of 3^h ; then the equation of

second difference is $x \cdot \frac{x-1}{z} \cdot (d - \delta)$. The time of describing this is $3^h \cdot x \cdot \frac{x-1}{z} \cdot \frac{d - \delta}{d}$
 $= 3^h \cdot x \cdot \frac{x-1}{z} - 3^h \cdot x \cdot \frac{x-1}{z} \cdot \frac{\delta}{d}$. The first member of which is the same throughout a

horizontal line in the table: the second member is proportional to $\frac{\delta}{d}$. Hence, pr. log.

d - pr. log. δ is made the argument of the table. The value of $x \cdot \frac{x-1}{z}$ is put down in Naut. Table (0) 3; whence it may be taken, if it be wished to compute the correction.

(36.) Here the hour angle P , the latitude l , and the declination d are given to find the zenith dist. The rule immediately follows from the logarithmic formula in App. 16. 1. From the zen. dist. the altitude is got by subtracting the former from 90° . The mer. zen. dist., denoted by $M. Z.$, is always equal to $l - d$, the proper algebraical signs being affixed to l and d (see App. 14).

(37.) Let XY (fig. Art. 225 of Naut. Astronomy) be supposed the true distance as first computed by rule, Art. 274. From this Greenwich mean time may be found as in

* It may be noticed here, that the values of *correction* and of A as put down in Naut. Table (w) are computed for the mean refraction, that is, for barometer at 30° and thermometer at 50° .

Art. 276. Then ZX, ZY, PX, PY being also known, the latitude may be computed by the rule in Art. 240 : XY, or the true distance just found, being considered arc (1). Afterwards the ship mean time may be computed by the rule in Art. 249, using the altitude best adapted for that purpose. Then the difference between the Gr. mean time got from the true distance and the ship mean time got from the altitude will be the required longitude in time.

(38.) In fig. App. 20, Z may be considered as the true zenith, or zenith on the spheroid, and Z' the reduced zenith (Art. 118 of 'Naut. Astronomy'), ZZ' being the celestial meridian. Then refraction will raise the heavenly body observed towards Z, and parallax (if any) will depress it from Z'. Let X be the true place of the heavenly body, considering only refraction. Then to find Z'X from ZX, the reduction ZZ' is taken from Naut. Table (h), or App. 4, and ZD, supposed the difference of ZX and Z'X, may be considered as the *diff. lat.*, the bearing or azimuth Z'ZX being a *course*, and ZZ' the *dist.* Such *diff. of lat.* may be at once taken from a *Traverse Table*. When the said bearing is less than 8 points or 90°, ZD is evidently *subtractive* from ZX to find Z'X; consequently, it is *additive* to the complement of ZX or the altitude corrected for refraction. When the bearing is greater than 8 points or 90°, ZD is *additive* to the zenith dist. ZX, and *subtractive* from the altitude. In the last case, what the bearing wants of 16 points or 180° must be used in opening the Traverse Table. Or, this correction may be computed as follows: add together log. *tan.* of reduction, and log. *cos.* of bearing, rejecting 10 from the index of the sum. The result will be the log. *tan.* of the correction. This rule supposes ZZ'D to be a right-angled spherical triangle, having a right angle at D.

(39.) Let t and t' denote the true altitudes, a and a' the apparent altitudes. Let x denote the true distance, and δ the apparent distance. Then, as in App. 34:

$$\frac{\cos. x - \sin. t \sin. t'}{\cos. t \cos. t'} = \frac{\cos. \delta - \sin. a \sin. a'}{\cos. a \cos. a'}, \text{ and } \frac{\cos. a - \sin. t \sin. t'}{\cos. t \cos. t'} - 1 = \frac{\cos. \delta - \sin. a \sin. a'}{\cos. a \cos. a'} - 1.$$

$$\text{Or, } \frac{\cos. x - (\sin. t \sin. t' + \cos. t \cos. t')}{\cos. t \cos. t'} = \frac{\cos. \delta - (\sin. a \sin. a' + \cos. a \cos. a')}{\cos. a \cos. a'}.$$

$$\text{Or, } \frac{\cos. x - \cos. (t - t')}{\cos. t \cos. t'} = \frac{\cos. \delta - \cos. (a - a')}{\cos. a \cos. a'}.$$

$$\text{And } \cos. x = \cos. (t - t') + (\cos. \delta - \cos. (a - a')) \frac{\cos. t \cos. t'}{\cos. a \cos. a'} = \cos. (t - t')$$

$$- 2 \sin. \frac{1}{2} (\delta + a - a') \sin. \frac{1}{2} (\delta - a - a') \frac{\cos. t \cos. t'}{\cos. a \cos. a'}. \text{ Or,}$$

$$\cos. x = \cos. (t - t') - 2 \text{hav. } \frac{1}{2} (\delta + a - a') \text{hav. } \frac{1}{2} (\delta - a - a') \sec. a \cos. t \sec. a' \cos. t'.$$

Putting $1 - \text{vers.}$ for $\cos.$

$$\text{vers. } x = \text{vers. } (t - t') + 2 \text{hav. } \frac{1}{2} (\delta + a - a') \text{hav. } \frac{1}{2} (\delta - a - a') \sec. a \cos. t \sec. a' \cos. t'.$$

$$\text{Hence, if } \text{vers. } \theta = 2 \text{hav. } \frac{1}{2} (\delta + a - a') \text{hav. } \frac{1}{2} (\delta - a - a') \sec. a \cos. t \sec. a' \cos. t'.$$

$$\text{Or, } \text{hav. } \theta = \text{hav. } \frac{1}{2} (\delta + a - a') \text{hav. } \frac{1}{2} (\delta - a - a') \sec. a \cos. t \sec. a' \cos. t'.$$

$$\text{Or for log. tab. } \therefore \text{hav. } \theta = \frac{1}{2} \text{hav. } (\delta + a - a') + \frac{1}{2} \text{hav. } (\delta - a - a') + \{ \sec. a + \cos. t - 20 \} + \{ \sec. a' + \cos. t' - 20 \} \quad (1)$$

$$\text{We have, } \text{vers. } x = \text{nat. vers. } (t - t') + \text{vers. } \theta \quad (2)$$

The last figures of the numerical values of each quantity between the brackets in formula (1) are put down in the second column of Naut. Tables (0) 4 . . p. 12* for star, the app. alt. being supposed to be corrected for refraction alone, as in the first part of the rule and example in pp. 140 and 141 of 'Naut. Astronomy.' When the alt. is corrected for parallax alone, as in the second part of the said rule and example, the values of log. *sec. a*, log. *cos. t*, log. *sec. a'*, log. *cos. t'*, are taken from the tables. When θ has been found in either case, the corresponding true distance is computed by formula (2).

When particular accuracy is required in the result of a lunar observation, the mean

refraction taken from 'Naut. Table,' pp. 8 and 9, should be corrected for barometer and thermometer (see 'Naut. Table,' p. 379, or App. pp. 245 and 246). In this case the first part of the computation must be made from the tables of *log. sec.* and *log. cos.*, as the second part is in the example in 'Naut. Astronomy,' p. 141.

(40.) Let P, Z, X, be the celestial pole, the *reduced* zenith, and the true place of the body with reference to parallax. Let X' be the app. place of the body as affected by parallax. Let P = true hour angle ZPX; P' = app. hour angle ZPX'; $z = ZX$; $z' = ZX'$; d = true decl.; d' = app. decl.; l = *reduced* lat. Then, with reference first to triangle ZPX, and secondly to triangle ZPX', we have (App. 16.)—

For Parallax in R. A.



$$1 \dots \frac{\cos. P}{\sin. P} \sin. Z = \frac{\cos. z}{\sin. z} \cos. l - \cos. Z \sin. l \dots (\text{App. 16. 7}).$$

$$2 \dots \frac{\cos. P'}{\sin. P'} \sin. Z = \frac{\cos. z'}{\sin. z'} \cos. l - \cos. Z \sin. l.$$

$$\text{Subtg. } \left(\frac{\cos. P}{\sin. P} - \frac{\cos. P'}{\sin. P'} \right) \sin. Z = \left(\frac{\cos. z}{\sin. z} - \frac{\cos. z'}{\sin. z'} \right) \cos. l;$$

Putting $\sin. (P' - P)$ for $\sin. P' \cos. P - \cos. P' \sin. P$; and $\sin. (z' - z)$ for $\sin. z' \cos. z - \cos. z' \sin. z$;

$$\text{We have, } \sin. (P' - P) \cdot \frac{\sin. Z}{\sin. P \sin. P'} = \frac{\sin. (z' - z)}{\sin. z'} \cdot \frac{\cos. l}{\sin. z}.$$

$$\text{Putting } \frac{\cos. d}{\sin. z} \text{ for } \frac{\sin. Z}{\sin. P'} \text{ and cancelling common divisor } \sin. z;$$

$$\frac{\sin. (P' - P)}{\sin. P'} \cos. d = \frac{\sin. (z' - z)}{\sin. z'} \cos. l = \sin. H \cos. l: \dots (\gamma)$$

where H denotes the horizontal parallax of body ('Naut. Astronomy,' Art. 118).

$$\text{Hence, } \sin. (P' - P) = \frac{\sin. H \cos. l \sin. P'}{\cos. d} = \sin. H \cos. l \sin. P' \sec. d.$$

Wherefore, putting $(P' - P)'' \sin. l''$ for $\sin. (P' - P)$; $H'' \sin. l''$ for $\sin. H$; and then dividing by $\sin. l''$;

$$(P' - P)'' \text{ or Parx. in R. A.} = H'' \cos. \text{red. lat. } \sin. \text{app. hour angle sec. tr. decl.}$$

Half this in T = $\frac{1}{30}$ { $H'' \cos. \text{red. lat. } \sin. \text{app. hour angle sec. tr. decl.}$ }.

$$\text{And } \log. \frac{1}{30} \text{ corr. in T} = (10 - \log. 30) \text{ (or } 8.522879) + \log. H'' + \log. \cos. \text{red. lat.} \} \\ + \log. \sin. \text{app. hour angle} + \log. \sec. \text{tr. decl.} - 40 \} \dots (1)$$

For Parallax in Declination.

$$\frac{\sin. d}{\cos. d} \cos. l \sin. P' - \sin. P' \cos. P \sin. l = \frac{\sin. d'}{\cos. d'} \cos. l \sin. P - \cos. P' \sin. P \sin. l.$$

$$(\text{Each being} = \frac{\cos. Z}{\sin. Z} \sin. P' \sin. P, \text{ by App. 16.})$$

$$\text{Hence, } \frac{\sin. d}{\cos. d} \cos. l \sin. P' = (\sin. P' \cos. P - \cos. P' \sin. P) \sin. l + \frac{\sin. d'}{\cos. d'} \cos. l \sin. P.$$

Putting $\sin. (P' - P)$ for $\sin. P' \cos. P - \cos. P' \sin. P$, and dividing by $\cos. l \sin. P'$,

$$\text{We have, } \frac{\sin. d}{\cos. d} = \frac{\sin. (P' - P) \sin. l}{\sin. P' \cos. l} + \frac{\sin. P}{\sin. P'} \cdot \frac{\sin. d'}{\cos. d'};$$

$$\text{And, } \frac{\sin. d'}{\cos. d'} = \dots \dots \frac{\sin. P'}{\sin. P'} \cdot \frac{\sin. d'}{\cos. d'};$$

$$\text{Subtg. } \dots \frac{\sin. d}{\cos. d} - \frac{\sin. d'}{\cos. d'} = \frac{\sin. (P' - P) \sin. l}{\sin. P' \cos. l} + \frac{\sin. P - \sin. P'}{\sin. P'} \cdot \frac{\sin. d'}{\cos. d'}.$$

Putting $\sin. (d - d')$ for $\sin. d \cos. d' - \cos. d \sin. d'$; and $-2 \sin. \frac{1}{2} (P' - P) \cos. \frac{1}{2} (P' + P)$ for $\sin. P - \sin. P'$; $\dots \dots \dots$ (5)

$$\frac{\sin. (d - d')}{\cos. d \cos. d'} = \frac{\sin. (P' - P) \sin. l}{\sin. P' \cos. l} - \frac{2 \sin. \frac{1}{2} (P' - P) \cos. \frac{1}{2} (P' + P)}{\sin. P'} \cdot \frac{\sin. d'}{\cos. d'}.$$

Putting $\sin. (P' - P)$ for $2 \sin. \frac{1}{2} (P' - P)$; and $\frac{\sin. H \cos. l}{\cos. d}$ for $\frac{\sin. (P' - P)}{\sin. P'}$.. (see γ above);

$$\frac{\sin. (d - d')}{\cos. d \cos. d'} = \frac{\sin. H \sin. l}{\cos. d} - \frac{\sin. H \cos. l}{\cos. d} \cdot \frac{\sin. d'}{\cos. d'} \cos. \frac{1}{2} (P' + P);$$

And $\sin. (d - d') = \sin. H \sin. l \cos. d' - \sin. H \cos. l \sin. d' \cos. \frac{1}{2} (P' + P)$;

Putting $(d - d)'' \sin. I''$ for $\sin. (d - d')$, $H'' \sin. I''$ for $\sin. H$, and then dividing by $\sin. I''$;
 $(d - d)'' = H'' \sin. \text{red. lat.} \cos. \text{app. decl.} - H'' \cos. \text{red. lat.} \sin. \text{app. decl.} \cos. \text{middle hour angle.}$

If then, *corr.* in decl. in secs. of arc = (suppose) $\alpha'' - \beta''$.

$\text{Log. } \alpha'' = \log. H'' + \log. \sin. \text{red. lat.} + \log. \cos. \text{app. decl.} - 20 \dots \dots \dots (2)$

$\text{Log. } \beta'' = \log. H'' + \log. \cos. \text{red. lat.} + \log. \sin. \text{app. decl.} + \log. \cos. \text{m. h. angle} - 30 (3)$

Formula (1) for parallax in R. A. gives the operation in the rule and example in 'Naut. Astron.' under (1); observing that the first four terms in the formula are added together in the first place, rejecting the tens from the index of the sum, by which a logarithm is got denoted by (a). The fifth term is then put under (a), using the *app. decl.* instead of the *true decl.*; that is, the *sec. app. decl.* is put under (a). By adding and rejecting 10 from the index of sum, the logarithm of *half parallax* in R. A. is got *nearly*. This being applied to the *app. hour angle*, the result is the *middle hour angle*, or $\frac{1}{2} (P' + P)$ *nearly*. With this approximate value of the *middle hour angle* the parallax in decl. is computed by rules for (2) and (3), in 'Naut. Astron.' which are obviously derived from formulæ (2) and (3) above. By applying the parallax in decl. so got to the *app. decl.*, the *true decl.* is found. Then under (a) (written down again) is put the *log. sec. true decl.* and $\log. 2$ or 0.301030; the sum of the three logarithms, rejecting 10 from the index, is the logarithm of the whole parallax in R. A.

Since the true place X of the body is nearer to the zenith than the *app. place X'*, the *app. hour angle ZPX'* must always be diminished, and consequently the *app. R. A.* increased, when the body is *west* of the meridian, and diminished when the body is *east* of the meridian.

1. It is assumed in the foregoing investigation that the *app. decl.* has the same name with the reduced lat. as N; that is, that it is + (App. 14), and also that $\frac{1}{2} (P' + P)$ is less than 6^h (or $\sin. P - \sin. P'$ is -, see δ above). On these suppositions the algebraical signs of α'' and β'' in the equation will be as they appear; α'' will be +, or of the same name with the *app. decl.*; β'' will be -, or of a different name from the *app. decl.*

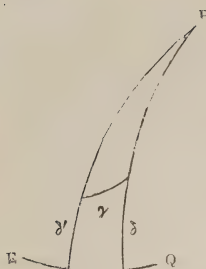
2. If the *app. decl.* have a different name from that of the *red. lat.*, or be -, $\frac{1}{2} (P' + P)$ being less than 6^h , α'' will still be +, because $\cos. d'$ is still +; that is, α'' will now have a different name from that of the *app. decl.*; and β'' will be +, since $\sin. d'$ is -; that is, β'' will have a different name from that of the *app. decl.*

If in case 1, $\frac{1}{2} (P' + P)$ be greater than 6^h (or $\sin. P - \sin. P'$ positive), α'' will still be +, or have the same name with the *app. decl.*; but since $\cos. \frac{1}{2} (P' + P)$ or $\cos. \text{mid. hour angle}$ is now - (see App. 11, note), β'' will now become +, or of the same name with the *app. decl.*

If in case 2, $\frac{1}{2} (P' + P)$ be greater than 6^h , α'' will be +, or of a different name from that of reduced lat.; and β'' will become -, or of the same name with the reduced lat., since in this case both $\sin. d'$ and also $\cos. \frac{1}{2} (P' + P)$ are -, and therefore $\sin. d' \cos. \frac{1}{2} (P' + P)$ is +.

From the above observations will be seen the correctness of the precepts in the rule in 'Naut. Astron.' respecting the signs of α'' and β'' .

(41.) Having found the *true R. A.* of the point of the moon's limb in contact with the star, the next part of the rule gives the necessary correction of this, in deducing therefrom the *true R. A.* of the moon's centre in time



Let γ = the moon's hor. semidiameter, δ = true decl. of point in contact as computed, δ' = decl. of moon's centre as taken from the 'Naut. Almanac' for the Greenwich date. Then,
 $(\sin. \frac{1}{2} P)^2 = \sec. \delta \sec. \delta' \sin. \frac{1}{2} (\gamma + \delta - \delta') \sin. \frac{1}{2} (\gamma - \delta - \delta')$..
 (App. 16. γ).

Putting $\text{arc}'' \sin. 1''$ for $\sin.$ arc in the smaller terms, we have,
 $\frac{1}{4} P''^2 \sin.^2 1'' = \sec. \delta \sec. \delta' \frac{1}{2} (\gamma + \delta - \delta') \sin. 1''$
 $\frac{1}{2} (\gamma - \delta - \delta') \sin. 1''$.

Cancelling $\sin.^2 1''$, and multiplying by 4;

$$P''^2 = \sec. \delta \sec. \delta' (\gamma + \delta - \delta')'' (\gamma - \delta - \delta')'';$$

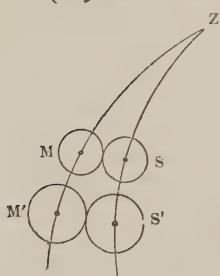
Or, (corr. in T) $''^2 \cdot 15^2 = \sec. \delta \sec. \delta' (\gamma + \delta - \delta')'' (\gamma - \delta - \delta')''$.

In logs. . . $2 \log. (\text{corr. in T})'' = 7.647818 + \log. \sec. \delta + \log. \sec. \delta' + \log. (\gamma + \delta - \delta')''$
 $+ \log. (\gamma - \delta - \delta')'' - 30$: which gives the part of the rule in question.

The true R. A. of moon's centre being found, the time in which it passes to this R. A. from the hour preceding as put down in the 'Naut. Almanac' is determined by the following proportion. As change of moon's R. A. (d) in the hour : change (d') from preceding hour till it arrives at the computed true R. A. :: 1^h or 3600 secs. : time required (t''): each term being supposed to be expressed in '' or seconds. Hence in logarithms

$\log t'' = \log. 3600$ (or 3.556302) $+ \log. d' - \log. d$; which gives the rule.

(42.) Let S' and M' be the apparent places of the sun and moon, S and M the true

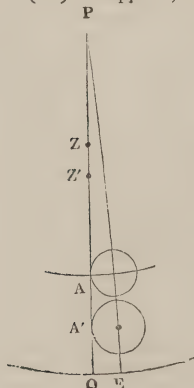


places thereof as raised by parallax towards the reduced zenith Z ; supposing the hor. parallax of the sun to be equal to that of the moon. On such a supposition the two bodies will still appear in contact, although the observer be removed from the surface to the centre of the earth. The distance of the centres of M and S will be the app. semidiameter of M' — augmentation (that is, the hor. semidiameter as found in the 'Naut. Almanac') + app. semidiameter of sun (the same as true semidiameter) — augmentation as if the sun were at the same distance with the moon. Hence the observations in the first part of Art. 290 of 'Naut. Astronomy.'

Again, the true R. A. and decl. of the sun, as taken from the 'Naut. Almanac,' may be considered as its app. R. A. and decl. provided the hor. par. of moon—hor. par. of sun be used in finding the true places S and M from the app. places S' and M' .

M' . For this is equivalent to correcting the sun's true place (using the sun's hor. par. in order to get its app. place) in one direction as to R. A. and decl.; and then correcting the app. place so got, using the moon's hor. par. in order to get its supposed true place in the opposite direction as to R. A. and declination. Hence appears the correctness of the latter part of Art. 290.

(43.) In App. 12, it is shown that $\text{sid. time} = \text{mean time} + \text{R. A. of mean sun}$, the



former of which is supposed to be known from the chronometer, and the latter from the 'Naut. Almanac.' But, at the instant the moon's limb is on the meridian, its R. A. in time is equal to sid. time . At this instant, therefore, we may suppose the R. A. of the moon's limb to be known. To get from thence the R. A. of the moon's centre, the semidiameter in R. A. in time is to be added or subtracted, according as the west or east limb has been observed. Let P be the celestial pole, Z the true zenith, and PZQ the meridian touching the moon as seen at A' from the surface of the earth, and also the moon as seen at A from the earth's centre; since A is depressed by parallax — refraction in the meridian PZA which passes both through the true zenith Z and the reduced zenith as Z' . Let γ'' be the hor. semidiameter of the moon in seconds of arc, which may be considered as part of a parallel at A round the pole P . Let d = true decl. of A or AQ ; and let PE be a circle of decl. passing through the centre of A . Then angle $P'' = \gamma'' \sec. d$,

and P in seconds of time = $\frac{\gamma'' \sec. d}{15}$. Consequently,

Log. P in seconds of T = ar. co. of log. 15 (or 8.823909) + log. γ'' + log. sec. $d - 20$. By adding P in seconds of time or subtracting it from *sid. time*, the R. A. of moon's centre is got.

The next step is to deduce therefrom Greenwich mean time. This is done as explained in the latter part of App. 41 (see rule in 'Naut. Astronomy,' p. 150).

(44.) Suppose the transit telescope to point a little to the *east* of the meridian, so as to give the R. A. of a star near the moon *one second* less than the truth. Then the supposed correction for the chronometer going according to *sid. time* would afterwards be +1 second. The same transit telescope would also give the R. A. of moon's limb as got above (supposing it to have the same declination as the star or nearly so) also *one second* too little, which would, however, be compensated by adding the supposed correction of the chronometer, namely +1 second.

If the chronometer should be adjusted to mean time, and its error on mean time deduced from the transit of the star, then at the transit of the moon's limb, mean time would be got from the chronometer, and thence *sid. time* deduced: which would amount to the same as above.

Suppose the interval between the transits of the star and the moon's limb to be noted by the chronometer going according to *sid. time* (the amount of any rate thereon being applied): or this interval in *sid. time* to be deduced from the interval noted in mean time. Then the said interval in *sid. time* would be, in a practical sense, the correct difference between the star's R. A. and that of the moon's limb at the time of its transit; although there might be a slight deviation of the transit telescope from the true meridian: this correct difference, therefore, being applied by addition or subtraction to the R. A. of the star (supposed also correct), the result will be the correct R. A. of the moon's observed limb.

(45.) In fig. 'Naut. Astronomy,' p. 44, P, Z, X, represent the celestial pole, the zenith, and the heavenly body; N represents the *north* point of the horizon; S the *south* point; E the east; and W the west. Then the rule for finding the true azimuth PZX is derived from App. 16. 6.

(46.) Error in Azimuth occasioned by small Error in Altitude.

From App. 30, it appears, that a small variation in the angle of a spherical triangle = corresponding small variation in an adjacent side $\times \cot$. of angle at extremity at that side $\times \sec$. of the compl. of said adjacent side. Applying this to triangle ZPX ('Naut. Astron.' p. 44), we have:

$$\text{Error in Z} = \text{error in alt.} \times \cot. X \sec. \text{alt.}$$

$$\text{Hence, when } X = 90^\circ, \text{ the error in az. or Z} = 0.$$

This must take place when the zenith dist. ZX touches the parallel described by the body round the pole P.

When angle of position X is very small or very near 180° , the error in azimuth occasioned by a small error in altitude will be very large.

$$\text{Since, (App. 16. 9), } \cot. X = \operatorname{cosec}. Z \tan. l \cos. a - \cot. Z \sin. a.$$

$$\text{Hence, Error in az.} = \text{error in alt.} \times \operatorname{cosec}. \text{az.} \tan. \text{lat.} - \text{error in alt.} \cot. \text{az.} \tan. \text{alt.}$$

This expression = 0 when the two members are equal and have different signs; in which case $\cot. \text{az.} \tan. \text{alt.} = \operatorname{cosec}. \text{az.} \tan. \text{lat.}$, or $\cos. \text{az.} = \tan. \text{lat.} \cot. \text{alt.}$: which equation holds good when the angle X is 90° as above.

When the azimuth is 90° , or the body bears due east or due west, then $\cot. \text{az.} = 0$, and $\operatorname{cosec}. \text{az.} = 1$. Hence in this case $\text{error in az.} = \text{error in alt.} \times \tan. \text{lat.}$. And since, $\tan. 45^\circ = 1$, when $\text{lat.} = 45^\circ$, $\text{error in az.} = \text{error in alt.}$

(47.) Error in Azimuth occasioned by a small Error in Latitude.

By proceeding as above, it appears that $\text{error in Z} = \text{error in lat.} \cot. P \sec. \text{lat.}$, which = 0 when P or the hour angle = 90° . When P is small or near 180° , the error in azimuth is very great, since then $\cot. P$ is very great.

$$\text{Since, (App. 16. 7), } \cot. P = \operatorname{cosec}. Z \tan. a \cos. l - \cot. Z \sin. l;$$

$$\text{Error in az.} = \text{error in lat.} \operatorname{cosec}. Z \tan. a - \text{error in lat.} \cot. Z \tan. l.$$

When $Z = 90^\circ$, then $\cot. Z = 0$, and $\operatorname{cosec}. Z = 1$. Hence in this case $\text{error in az.} = \text{error in lat.} \tan. a$. When the $\text{alt.} = 45^\circ$, $\text{error in az.} = \text{error in lat.}$

since $\cos. 90^\circ = o$, while $\cot. OXY = (\text{now}) \cot. Z$ is finite. Also, the first member of the expression increases from e to infinity as OX increases from o to OZ . The limit must therefore be fixed at some intermediate point. This limit is made, in the rule ('Naut. Astronomy,' p. 159, to take place when the angle $OYX = 45^\circ$, which can be estimated by the eye with sufficient accuracy. Now, when $OYX = 45^\circ$, $\frac{\cot. OXY}{\cos. OX} = \cos. OY$ (see

note *). Hence, the error in $Z = e \cdot \frac{1}{\cos. 45^\circ} + e' \cos. OY$: which (since $\cos. 45^\circ = \sqrt{\frac{1}{2}}$ = nearly 1.4 , and $\cos. OY$ is always less than 1) must be less than $1.4 \times e + e'$. When Z or OY does not differ much from 90° , the greatest error in Z , supposing the just mentioned limit in OYX to be attended to, will be little more than $1.4 \times e$: so that in such a case the angle OYX might be taken greater than 45° , or OX taken nearly 60° .

When Z or OY is greater than 90° , a similar conclusion may be easily arrived at in a similar manner respecting the angle OYX .

(51.) If a common theodolite is at hand, the horizontal position of the terrestrial object may be easily ascertained by means of the telescope, whose central line is supposed to be adjusted so as to be truly horizontal. By means of an universal theodolite or altitude and azimuth instrument (Ar, 116 and 376 of 'Naut. Astronomy'), this may be done more exactly. If no instrument of this kind is at hand, a common level with sights may supply its place; and when this cannot be obtained, a long shallow vessel placed securely and filled to the brim with water may answer the purpose, the surface of the water being truly horizontal.

(52.) When the bearing of an object at some elevation is required, its altitude must be observed as well as that of the heavenly body. This may be done with a theodolite, or, if the object be high enough, with a sextant by reflection from an artificial horizon.

The rule for computation will then be as follows: supposing A to denote the terrestrial object and B the celestial one,

RULE. Put the app. alt. of A under that of B , and take the difference, under which put the app. distance. Take the sum and difference. Then to log. *secants* of two first terms, rejecting the tens from the indices, add half the log. *havversines* of the two last terms. The sum will be the log. *havvers* of the difference of bearings of A and B . App. (16. 4.)

(53.) When the altitude of the heavenly body cannot be correctly observed, the time may be taken by a chronometer, whose error and rate on mean time at the place have been previously determined. The hour angle of the body may then be deduced as in Art. 199 of 'Naut. Astronomy,' and its true zen. dist. computed as in Art. 279, of 'Naut. Astron.' from which the azimuth or bearing of the body may be got as in Art. 304. This being increased or diminished by the difference of bearing got from the app. distance, the result will be the required bearing of the terrestrial object.

(54.) The time by chronometer when the body passes the meridian may be found as in Art. 203 of 'Naut. Astron.,' and at that instant the distance may be observed. The bearing of the body is then either N . or S ., and the bearing of the object will be the angle computed from the app. distance, to be reckoned from the north or south according to circumstances.

(55.) The time by chronometer may be found, when the body bears E . or W ., and at that instant the distance may be observed. The bearing of the object may then be got as in the last Art., to be reckoned from E . or W . instead of N . or S .

To find the time by chronometer, when a heavenly body bears E . or W ., add together log. *cot.* lat. and log. *tan.* decl., rejecting 10 from the index of sum. The result will be the log. *cos.* hour angle. From this hour angle find *mean time*, as in Art. 201 of 'Naut. Astron.': apply to this the error of chronometer on mean time at that instant, adding if *fast*, and subtracting if *slow*. The result will be the time shown by chronometer when the body bears E . or W .

This rule is easily proved by considering that the angle at Z is then a right angle (fig. p. 44 of 'Naut. Astronomy.')

* $\cos. XY = \cot. OYX \cot. OXY = \cot. OXY$, since $\cot. OYX = \cot. 45^\circ = 1$.
Hence, $\frac{\cos. XY}{\cos. OX}$ (which = $\cos. OY$) = $\frac{\cot. OXY}{\cos. OX}$.

(56.) The time by a chronometer may be found when a circumpolar star is at its greatest elongation; that is, when its zen. dist. touches its circle of diurnal motion, and the bearing of the body may then be easily computed, which bearing for stars near the pole does not change much for a considerable interval.

To find mean time then, add together $\log. \tan.$ lat. and $\log. \cot.$ decl., rejecting 10 from index of sum. The result will be $\log. \cos.$ hour angle, from which mean time may be found as in Art. 201. Proceed then as in App. 53. To find bearing of body add together $\log. \sec.$ lat. and $\log. \cos.$ decl., rejecting 10 from the index of sum. The result will be the $\log. \sin.$ bearing, reckoning from N. in north lat., and from S. in south latitude.

These rules are easily proved by considering that the angle at the body between the polar dist. and zen. dist. is then a right angle.

(57.) When an altitude and azimuth instrument is at hand (Art. 116 and 376 of 'Naut. Astronomy'), the bearing of a terrestrial object may be much more easily determined as follows. The place of the index on the horizontal circle is known from adjustment, when the middle wire of the telescope is in the meridian. The arc between this point and the point it stands at, when the middle wire is directed to the object, will be the bearing required.

(58.) Or, the time by chronometer being found when the body is on the meridian, several differences of bearing between it and the object may be taken with the instrument a little before the time of transit and a little after, together with the times by chronometer. A mean of these may be reduced to the time of transit by proportioning. This method will be found very correct in the result, since the change of bearing is in this case proportional, or very nearly so, to the time elapsed.

(59.) A similar mode of proceeding to that described above in Art. 55 may be adopted with this instrument, when the body is known, by means of the chronometer, to bear E. or W., or when a circumpolar star is thus known to be at its greatest elongation (see 55 and 56 above).

The above different modes of proceeding will at least furnish the nautical observer with profitable practice. The altitude of the heavenly body should not be more than 45° . The less it is the better.

(60.) Let A and B (fig. p. 90 of 'Naut. Astronomy') be supposed to be raised equally from the plane of the paper to two other points, as A', B'; the points A and B being considered as in a great circle perpendicular to the axis round which PQ has been turned, and having its pole in this axis, and A' and B' being in secondaries to this great circle. Then, if the eye were raised equally up a line parallel to the said axis, that is, to a level with A' and B', the image of A, now at A', would still appear to coincide with B, now at B'; the reading off on the instrument or instrumental angle, namely ACB, remaining correct. To find the angle subtended by A' and B' at the point E on the plane of the paper; since A' B' is a parallel to A B and similar thereto—

$$\text{Arc AB} : \text{arc A'B'} :: \frac{1}{2} \text{ chord of AB} : \frac{1}{2} \text{ chord of A'B'}$$

$$\text{Or, } 1 : \cos. AA' :: \sin. \frac{1}{2} ACB : \sin. \frac{1}{2} A'EB'$$

$$\text{Hence, } \sin. \frac{1}{2} A'EB' = \sin. \frac{1}{2} ACB \cos. AA'$$

$$\text{And } (\sin. \frac{1}{2} A'EB')^2 = (\sin. \frac{1}{2} ACB)^2 (\cos. AA')^2$$

$$\text{Or, hav. } A'EB' = \text{hav. } ACB (\cos. AA')^2$$

$$\text{Wherefore, } \log. \text{hav. } A'EB' = \log. \text{hav. } ACB + 2 \log. \cos. AA' - 20. \dots$$

Where A'EB' is the true angle subtended at the eye by A'B', ACB is the instrumental angle or angle measured by the sextant, and AA' is the inclination of the line of collimation of the telescope or line of vision to the plane of the sextant.

Ex. Let the inclination be supposed 1° , and the instrumental angles 90° and 150° .

$$2 \log. \cos. 1^\circ = 19.999868 \dots \dots 19.999868$$

$$\log. \text{hav. } 90^\circ = 9.698970 \quad \log. \text{hav. } 150 = 9.969887$$

$$\text{Hav. } 89^\circ 58' 57'' = 9.698838$$

$$9.969755 = \log. \text{hav. } 149^\circ 56' 1''$$

$$\text{Error} = 1' 3''$$

$$\text{Error} = 3' 59''$$

It hence appears, that a slight error in the position of the line of collimation will produce a considerable error in the angle observed, especially when that angle is large; and, therefore, that an observer should take care to examine the adjustment in question, when-

ever a good opportunity occurs, and also make the coincidence or contact at the middle point of the field of view as accurately as possible.

(61.) Let the direction of the mean horizontal disturbing force make an angle A with the natural position of the needle. Then the force being resolved into two equivalent forces, one in the direction of the needle, and the other perpendicular to the needle, the latter alone can be effective in turning the needle horizontally round the pivot. And this for different angles A is evidently proportional to $\sin. A$. When $A = 90^\circ$ or the direction of the horizontal disturbing force is perpendicular to the needle, then $\sin. A = \text{rad.} = 1$, and the effect is the greatest. Let this be denoted by m , and the effect at any angle A by x . Then

$$1 : \sin. A :: m : x = m \sin. A. \text{ Hence, } \frac{3^h}{x} = \frac{3^h}{m} \cdot \frac{1}{\sin. A} = \frac{3^h}{m} \cdot \text{cosec. } A; \text{ hence}$$

prop. log. $x = \text{prop. log. } m + \text{log. cosec. } A$, (or prop. log. $m + \text{log. sec. } 90^\circ - A$), -10 : where $90^\circ - A$ is the angle which the above-mentioned direction deviates from a perpendicular to the needle.

To enable a seaman to correct a ship's courses, &c., taking into account the effect of the ship's local attraction on the binnacle-compass, one of the following methods of proceeding may be adopted.

METHOD 1.

When the ship is fully equipped, and in every respect as if at sea, let it be moved into a place whence can be seen distinctly a well-defined object on shore, if necessary previously fixed there, at least 70 or 80 yards from the ship. At such an object let a compass be put, agreeing accurately with the binnacle-compass when neither is acted on by local attraction. Let the ship be then swung or otherwise brought round, so as to place the head thereof, seen from the binnacle, in the direction of each point of the binnacle-compass. In doing which any small change in the ship's place would not be of any consequence.

The ship being kept steady at each position just mentioned, take with the binnacle-compass, or with one immediately above it and accurately agreeing therewith, the bearing of the shore-object; and at the same instant (known by signal) let the bearing of the binnacle-compass, or of a mark put immediately above it, be taken with the shore-compass. This being done for each position of the ship, take the opposite points to those given by the shore-compass, and put them under the corresponding bearings read off the binnacle-compass. Take the difference of each pair, marking it E. or W. according as the opposite bearing to that by the shore-compass (which is in fact the true compass bearing of the shore-object from the ship) is to the right (*r.*) or left (*l.*) of the binnacle-compass bearing thereof. Place the results in a Table as X (see following table) under a heading *Deviation*. These will be the effects in bearing of local attraction in the ship, corresponding to the several positions of the ship's head as put opposite in the table.

Example.—When the ship's head lies N.N.E., let the binnacle-compass bearing of the shore-object be N. $19^\circ 30'$ E., and the bearing of the binnacle-compass from the shore-object be S. $27^\circ 0'$ W.; required the *deviation*.

The opposite point to S. $27^\circ 0'$ W. is N. $27^\circ 0'$ E., which is $7^\circ 30'$ to the right of N. $19^\circ 30'$ E. Hence the *deviation* is $7^\circ 30'$ E.

Correcting Binnacle-Compass Courses, &c., according to Method 1.

Allow deviation corresponding to the position of the ship's head in table as in X, in the same manner as variation is allowed (see 'Naut. Astronomy,' Arts. 43, 44); that is, when marked E. allow it to the *r.*, when W. to the *l.* Then allow true variation (supposed to be known) as usual ('Naut. Astronomy,' Arts. 43, 44).

Conversely, in finding binnacle-compass courses or bearings from true or calculated ones, allow *deviation** and true variation with contrary names to the tabular ones, that is *l.* or *r.*, according as they are E. or W.

Example 1.—On Oct. 2 the course by compass is S.W. by W. or S. $56^\circ 15'$ W., the true variation being $24^\circ 30'$ W., and the leeway $\frac{1}{2}$ point to the *r.*; required the true course.

* In taking out the deviation the table as X should in strictness be entered with the binnacle-compass bearing. To get a more correct result, if required, the operation as in *Ex. 2* may be repeated, using the first result for the said binnacle-compass bearing

The quantities to be considered are as follows :—

Bin. Comp. Course.	Deviation Tab. X.	Tr. Var.	Leeway.
56° 15' <i>r.</i> of S.	7° 27' <i>l.</i>	24° 30' <i>l.</i>	5° 37' <i>r.</i>

The aggregate of these is 29° 55' *r.* of S., or S. 29° 55' W., or nearly S.S.W. $\frac{3}{4}$ W.

Example 2.—On Oct. 3 the true or calculated course is N. 56° 15' E., or N.E. by E.; required the corresponding course by binnacle-compass.

The quantities to be considered are as follows :—

Calculated Course.	Deviation X.	Tr. Var.
56° 15' <i>r.</i> of N.	10° 55' <i>l.</i>	24° 30' <i>r.</i>

The aggregate of these is 69° 50' *r.* of N., or N. 69° 50' E., or nearly E. by N. $\frac{3}{4}$ N. In a second operation (note, p. 277) entering table X with E. by N. $\frac{3}{4}$ N., or the nearest thereto, for the position of the ship's head, we get 10° 40' E. for the *deviation*. Using this instead of 10° 55' E. as in the first operation, we get the required binnacle-compass course N. 70° 5' E.

The above method supposes the true variation to be known. But at sea the true variation cannot generally be known without making an observation of the azimuth or amplitude of a heavenly body, and thence determining the binnacle-compass variation to be afterwards corrected for *deviation* with a contrary name to the tabular one. So that the whole process of Method 1 must be somewhat troublesome. It seems better therefore to form a table as Y of binnacle-compass bearings both before sailing and at sea, as follows under Method 2.

METHOD 2.

Having made the experiment of swinging the ship or bringing it round as described under Method 1 above, correct the opposite bearings to those taken from the shore-object for true variation, supposed to be known at the place of experiment. Put the results under the corresponding bearings of the shore-object from the binnacle-compass, and take the differences of the pairs, marking such differences E. or W., according as the corrected opposite bearings are to the right (*r.*) or left (*l.*) of those taken with the binnacle-compass of the shore-object. Put the results in a table as Y, column *a*, opposite to the corresponding positions of the ship's head. These will be the binnacle-compass bearings to be applied in correcting courses, &c. at sailing and for a short time after sailing.

AT SEA.

After the ship has got out to sea, find the variation for the binnacle-compass from an observed azimuth or amplitude of a heavenly body ('Naut. Astronomy,' Arts. 304, 306), the position of the ship's head being noted at the time. Then see how much the result differs from the corresponding variation in table as Y, column *a*. Allow the same difference,* and in the same direction, right (*r.*) or left (*l.*), for each of the other tabular variations in table as Y, column *a*, and mark the results E. or W. (see examples below.) That is, if the numbers put under each other in making the allowance have the same name, mark the result with this name also; if they have different names, mark it with the name of the greater; *r.* answering to E. and *l.* to W. With these results fill up a fresh column *b* in table as Y for further use at sea, till another observation is got for binnacle-compass variation, and so on.

Construction of Column (b) in Table as Y.

Example.—Let the binnacle-compass variation, found at sea on Oct. 5 soon after sailing, be 11° 25' W., the ship's head being N.E.; which variation is 3° 5' to the right (*r.*) of the corresponding one in column *a*, table Y; namely, 14° 30' W. Allowing 3° 5' to the right (*r.*) of all the numbers in column *a*, as below, we get the numbers put down in column *b* as follows :—

Ship's head . . . N.	N. by E.	N.N.E.	&c.
<i>a</i> 21° 45' <i>l.</i>	19° 33' <i>l.</i>	17° 0' <i>l.</i>	
Difference . . . 3° 5' <i>r.</i>	3° 5' <i>r.</i>	3° 5' <i>r.</i>	
<i>b</i> 18° 40' <i>l.</i> or W.	16° 28' <i>l.</i> or W.	13° 55' <i>l.</i> or W. &c.	

* The required difference may often be determined at sea by observing with the binnacle-compass the bearing of a distant object, as a point of land, a ship, boat, &c., whose true bearing is found as in 'Naut. Astronomy,' Art. 307.

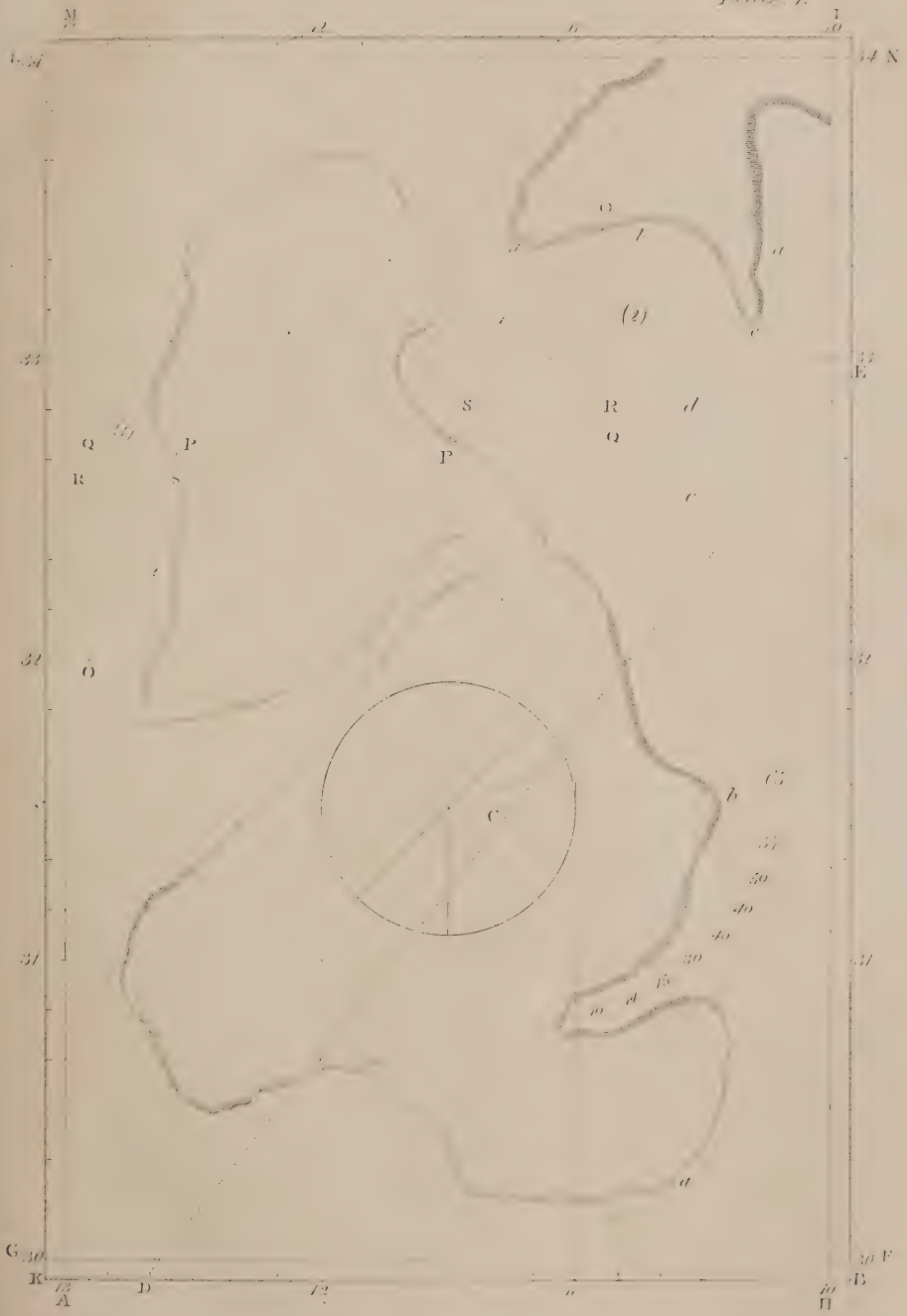
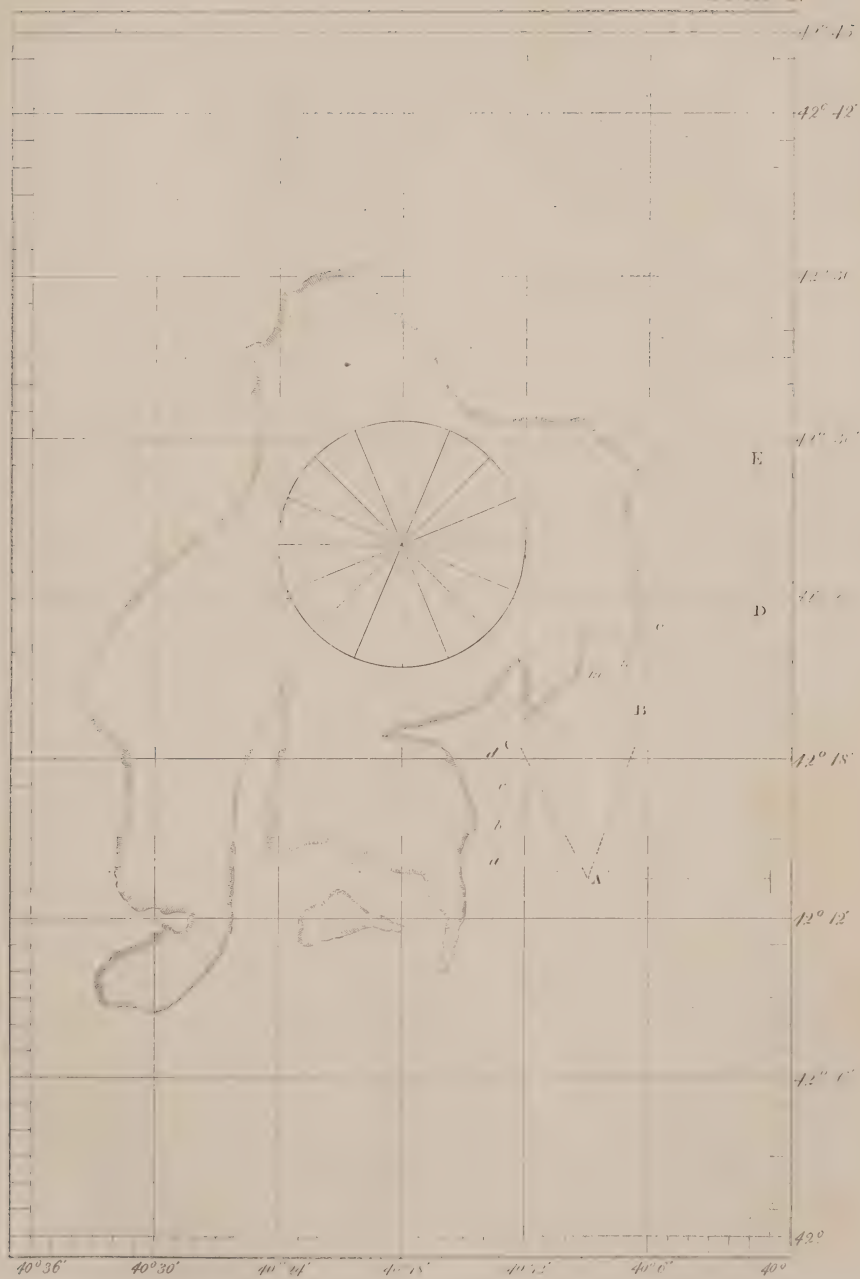




Plate 3.



Correcting Binnacle-Compass Courses, &c. at Sea.

To find true course from binnacle-compass course, apply variation taken from the last column filled up in table as Y as usual ('Naut. Astronomy,' Arts. 43, 44.)

To find binnacle-compass course from true or calculated course, apply variation from last column filled up in table as Y, as usual with a contrary sign.

Example 1.—On Oct. 7 the course by binnacle-compass is N.N.E. or N. $22^{\circ} 30'$ E., the wind being E. and leeway 2 points; required the true course.

The quantities to be considered are as follows:—

Bin. Comp. Course.	Bin. Comp. Var. (b.)	Leeway.
$22^{\circ} 30'$ r. of N.	$13^{\circ} 55'$ L.	$22^{\circ} 30'$ L.

The aggregate of these is $13^{\circ} 55'$ L. of N., or N. $13^{\circ} 55'$ W., or N. by W. $\frac{1}{4}$ W.

Example 2.—On Oct. 7 the true or calculated course is N. $45^{\circ} 0'$ W. or N.W., the wind being S. by E.; required the course to be steered by binnacle-compass.

The quantities to be considered are as follows:—

True Course.	Bin. Comp. Var. (b.)	Leeway.
$45^{\circ} 0'$ L. of N.	$26^{\circ} 15'$ r.	$0^{\circ} 0'$

The aggregate is $18^{\circ} 45'$ L. of N., or N. $18^{\circ} 45'$ W., or between N. by W. $\frac{1}{2}$ W. and N. by W. $\frac{3}{4}$ W.

By a second operation (note, p. 277), taking out the binnacle-compass variation from column *b* in table as Y for ship's head between N. by W. $\frac{1}{2}$ W. and N. by W. $\frac{3}{4}$ W., the required course is 23° L. of N., or nearly N.N.W.

Remarks.

1. It may be remarked that in the two methods given above for correcting courses and bearings, &c., taking into account the effects of the ship's local attraction, it has been supposed that *deviation* arising from such local attraction continues the same, although during a voyage probably of great extent, the stowage &c. may have undergone considerable changes. To verify such an assumption, or if necessary to correct it, fresh experiments of bringing the ship round should be made, as described above, whenever favourable opportunities occur for doing so.

2. It may be remarked also that the two methods given above should not by any means supersede the use of the method described in p. 160 of 'Naut. Astronomy.' For it will at all times be both useful and interesting to compare the results of this latter method with those of the two given above. Besides it is possible that in some cases swinging or bringing a ship round, selecting or placing an object on shore, &c., previous to sailing, may be attended with inconvenience; whereas the process detailed in p. 160 of 'Naut. Astronomy' cannot but be frequently practicable at sea without any inconvenience whatever.

TABLE X. At Sailing Oct. 1, 1849.

True Variation $24^{\circ} 30'$ W.

Ship's Head.	Deviation.	Ship's Head.	Deviation.	Ship's Head.	Deviation.	Ship's Head.	Deviation.
	o /		o /		o /		
North	2 45 E.	East	8 50 E.	South	3 0 W.	West.	8 50 W.
N. by E.	4 57 E.	E. by S.	7 15 E.	S. by W.	4 20 W.	W. by N.	8 10 W.
N.N.E.	7 50 E.	E.S.E.	5 35 E.	S.S.W.	5 0 W.	W.N.W.	6 50 W.
N.E. by N.	9 0 E.	S.E. by E.	3 40 E.	S.W. by S.	6 7 W.	N.W. by W.	5 40 W.
N.E.	10 0 E.	S.E.	1 50 E.	S.W.	7 0 W.	N.W.	4 50 W.
N.E. by E.	10 55 E.	S.E. by S.	0 20 E.	S.W. by W.	7 27 W.	N.W. by N.	3 20 W.
E.N.E.	10 40 E.	S.S.E.	0 56 W.	W.S.W.	7 50 W.	N.N.W.	1 40 W.
E. by N.	9 55 E.	S. by E.	2 20 W.	W. by S.	8 20 W.	N. by W.	1 10 E.

TABLE Y. At Sailing Oct. 1, 1849.

True Variation $24^{\circ} 34' W.$

Ship's Head.	Variation of Binnacle Compass.			Ship's Head.	Variation of Binnacle Compass.		
	October 1. (a)	October 5. (b)	October 8. (c)		October 1. (a)	October 5. (b.)	October 8. (c)
North.	0 / 21 45 W.	0 / 18 40 W.		South	0 / 27 30 W.	0 / 24 25 W.	
N. by E.	19 33 W.	16 28 W.		S. by W.	28 50 W.	25 45 W.	
N.N.E.	17 0 W.	13 55 W.		S.S.W.	29 30 W.	26 25 W.	
N.E. by N.	15 30 W.	12 25 W.		S.W. by S.	30 37 W.	27 32 W.	
N.E.	14 30 W.	11 25 W.		S.W.	31 30 W.	28 25 W.	
N.E. by E.	13 35 W.	10 30 W.		S.W. by W.	31 57 W.	28 52 W.	
E.N.E.	13 50 W.	10 45 W.		W.S.W.	32 20 W.	29 15 W.	
E. by N.	14 35 W.	11 30 W.		W. by S.	32 50 W.	29 45 W.	
East	15 40 W.	12 35 W.		West	33 20 W.	30 15 W.	
E. by S.	17 15 W.	14 10 W.		W. by N.	32 40 W.	29 35 W.	
E.S.E.	18 55 W.	15 50 W.		W.N.W.	31 20 W.	28 15 W.	
S.E. by E.	20 50 W.	17 45 W.		N.W. b. W.	30 10 W.	27 5 W.	
S.E.	22 40 W.	19 35 W.		N.W.	29 20 W.	26 15 W.	
SE. by S.	24 10 W.	21 5 W.		N.W. by N.	27 50 W.	24 45 W.	
S.S.E.	25 25 W.	22 21 W.		N.N.W.	26 10 W.	23 5 W.	
S. by E.	26 50 W.	23 45 W.		N, by W.	23 20 W.	20 15 W.	

THE END.

NAUTICAL TABLES,

DESIGNED FOR THE

USE OF BRITISH SEAMEN.

BY THE

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NEW EDITION.  
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LONDON:

RIVINGTONS, WATERLOO PLACE.

1858.

LONDON: PRINTED BY W. CLOWES AND SONS, STAMFORD STREET.

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EXPLANATION AND USE OF TABLES.

Table (a), p. 1. *Catalogue of Bright Stars.*—This table contains the *mean* right ascension (R. A.), and *mean* declination of some of the brightest stars. They are of use in finding the latitude at sea by meridian altitudes and double altitudes, and in finding the longitude by time-keeper and lunar observation, &c. Strictly, the *mean* R. A. and declination of a star should be reduced to the *apparent* R. A. and declination, by applying the proper equations. The error arising, however, from the omission of these equations will be of no great practical importance in navigation. For *apparent* R. A. and decl. of several of the brightest stars, see Nautical Almanac.

In taking the mean R. A. and declination of a star from this table, first put them down as in the proper column for the beginning of 1830, and then apply the ann. variation for the number of years after 1830, and for the part of any year. For 1829, the ann. variation must be applied with a contrary sign to the one in the table.

Table (b), p. 2. *Parallax in Altitude for Planets.*—Enter with the hor. parallax of a planet (supposed to be known from the Nautical Almanac) at the top, and the app. altitude of planet at the side. Thus will be found the parallax in altitude, to be *added* to the app. alt. to get the true alt. The app. alt. is first supposed to be corrected for refraction, as for a fixed star. See Tab. (n.)

Table (c), p. 2. *Correction of A for Planet in clearing Distance.*—For explanation of this table, see that of Table (w.)

Table (cc), p. 2. *Sun's Parallax in Altitude.*—The effect of parallax in alt. for the sun, is included in correction of Table (m): it is put down here, as it is occasionally of use considered separately. (See Navigation on Occultations, p. 180.)

Table (d), p. 3. *Points of the Compass, &c.*—This table is of use in turning the points of the compass into degrees, and conversely: also, in finding at once the log. sines of points and quarter points.

Table (e), p. 3. *Dip of the Sea Horizon.*—The altitude of a heavenly body is taken in the open sea with Hadley's quadrant, in doing which the image is brought down to the apparent sea horizon, which is below the level of the eye. The observed altitude is on this account something too great. The necessary correction is put in Table (e), which is entered with the estimated height of the eye above the sea. The correction or dip taken out is *subtractive* *

* In computing this table, it is necessary to consider the effect of horizontal refraction in raising the visible sea horizon, which has been found to be about 8-100ths of the dip independently of this correction. But this effect varies with the state of the air near the sea horizon. Hence the correction applied for dip may frequently be erroneous; and this is one cause why altitudes taken at sea, particularly those taken near the horizon, are not to be depended on where great accuracy is required.

Table (f), p. 3. *Dip of a Shore Horizon*.—Sometimes the observer is obliged to bring the image down to the shore of an island or continent, over which the heavenly body happens to be. In this case the dip is greater than in the open sea. The table is entered with the estimated height of the eye and the estimated distance of the shore; the correction taken out is *subtractive*.

Table (g), p. 4. *Augmentation of the Moon's Semidiameter*.—The semidiameter of the moon put down in the Nautical Almanac is computed on the supposition that the spectator is at the centre of the earth; whereas he is on the surface; and therefore, when the moon is above the horizon, he is nearer to the moon than if he were at the centre. Consequently the apparent semidiameter is something greater than what is taken out of the Nautical Almanac. The No. of seconds to be added is taken from Table (g), which is entered with the moon's apparent altitude at the side, and the semidiameter to the nearest 10'' at the top.

Table (h), p. 4. *Reduction of Horizontal Parallax, and Latitude of Place for Figure of Earth*.—The *hor. parallax* of the moon in the Nautical Almanac is put down for a place on the earth's equator. At any other place on the earth it will be something less; since, on account of the compression towards the poles, the earth's semidiameter is there less than at the equator. The seconds to be subtracted are found in this table by entering with *hor. par.* at the top, and with *lat.* at the side.

The *latitude* of a place on the earth is the arc between the true zenith and the equator: this is called the latitude on the *spheroid*. It is occasionally necessary to reduce this to the latitude of the same place, on the supposition that the surface of the earth at the same place is exactly *spherical*. The seconds to be subtracted for this purpose are put down in the last column of this table. (See Occultation of Fixed Stars in Navigation.)

Table (i), p. 4. *Reduction of Semidiameter on account of Refraction*.—In correcting a lunar distance it is usual to apply the semidiameter of the moon, as seen from the earth's centre, corrected only for augmentation (Table g); but generally a further correction should be applied for the effect of refraction. The extremities of any diameter of the moon inclined to the horizon, being at different altitudes, are unequally raised by refraction, the lower extremity being the more raised; hence a contraction of the diameter takes place. The necessary correction for the semidiameter, which is always *subtractive*, is found from this table, by entering it with the inclination of the line between the bodies observed, as the moon and a star, and the altitude at the side; the inclination may be estimated by the eye. A similar correction should be applied also to the sun's semidiameter.

Table (k), p. 3. *Correction in finding Moon's Meridian Passage*.—In *west* longitude the moon passes the meridian later, that is, longer after the sun, than at Greenwich; because then her distance from the sun in R. A. (reckoning from W. to E.) is greater than it was at the Greenwich meridian passage. In *east* longitude the meridian passage takes place sooner. The necessary correction of the time of the Greenwich passage is taken from this table, by entering it with the longitude at the top, and at the side the difference between the times of two successive Greenwich passages, one on the given day, the other on the day following, in *west* longitude, but the

difference between the passages on the given day and the day preceding, in east longitude.

Table (l), p. 5. *Correction in finding Time of High Water.*—By the change tide is meant the high water when the moon and sun are in conjunction, or appear from the earth in the same part of the heavens. If the moon and sun always remained in this position, the time of high water would be the same always with the change tide: but as this is not the case, a correction becomes necessary; which is found from this table by entering it with the time of the moon's meridian passage for the place at the side, and the moon's semidiameter (taken by inspection from the Nautical Almanac) at the top.

Table (m), p. 6. *Correction of the Sun's Apparent Altitude.*—The sun's apparent altitude is greater than its true altitude on account of refraction, and less on account of parallax. But since the refraction is greater than the parallax, the necessary correction on the whole, or the difference of refraction and parallax, must be subtractive. To find therefore the true altitude of the sun from its apparent altitude, enter this table with the latter, and take out the corresponding number in the column marked *corr.*, which subtract.

The correction taken from this table, if necessary, should be increased or diminished by the number in Table (z 4), p. 379, Correction of Mean Refraction.

Table (n), p. 8. *Correction of a Star's Apparent Altitude.*—A star has no parallax; hence the only correction to be applied to its apparent altitude, in order to get the true altitude, is for refraction, which is put down in this table in the column marked *corr.* The table is entered with the star's apparent altitude, and the correction taken out is subtractive.

The refraction put down in this table, and used in the last, is computed from Dr. Young's Table of Refraction, (see Nautical Almanac.)

Table (o), p. 10. *Correction for Pole Star.*—The true altitude of the pole of the heavens is equal to the latitude of the place; hence the true altitude of the pole star (which is within about $1\frac{1}{2}$ degree of the pole) is nearly so. The necessary correction of the true altitude is found from this table, by entering it with the R. A. of meridian (= the sun's R. A. + app. time) at the side, and the nearest year and nearest latitude at the top.

Table (p), p. 13. *Greenwich Date Logarithm for the Moon.*—By means of this table and the table of proportional logarithms, the proportional part of the moon's declination, right ascension, &c., for any Greenwich date, may be very easily computed as follows. Take from this table the logarithm corresponding to the hours and minutes of the Greenwich date, or if it is greater than 12 hours, with the excess above twelve hours. To this logarithm add the proportional logarithm of the change of the declination, right ascension, &c., in the 12 hours in which the date lies; the sum will be the proportional logarithm of the part required.

If the change of the declination or right ascension be more than 3° , use the proportional logarithm of half the change, and double the proportional part which results. This double will be the part required.

Table (q), p. 14. *Greenwich Date Logarithm for the Sun.*—The proportional part of the sun's declination, right ascension, &c., may be found by

means of this table and the table of proportional logarithms as follows. Take from this table the logarithm corresponding to the hours and minutes of the Greenwich date, to which add the proportional logarithm of the change of the sun's declination, right ascension, &c., in the 24 hours in which the date lies. The sum will be the proportional logarithm of the part required.

Table (qq), p. 16. *Proportional Logarithms for Seconds and Tenths of Seconds*.—This table may be of use in finding the proportional part, where the daily or half daily difference is small, and expressed in seconds and tenths of seconds. See explanation of Tables (p), (q), and (r.)

Table (r), p. 13*. *Proportional Logarithms*.—It is frequently necessary to work proportions by logarithms, whereof one of the terms is 3 hours. To do this by common logarithms would be extremely tedious, since it would be necessary to reduce every term into seconds, then to take their logarithms from the tables, and finally to bring the resulting seconds into hours, minutes, and seconds. To shorten such operations, the logarithms of every number of seconds below 3 hours are subtracted from the logarithm of the seconds in 3 hours. The results are arranged in a table, and called proportional logarithms; the corresponding hours and minutes being placed at the top of the page, and the seconds at the side.

Since degrees, minutes, and seconds, have the same proportion to each other as hours, minutes, and seconds, it is manifest that the same numbers will be proportional logarithms of any number of degrees, minutes, and seconds, less than 3° .

If any term of four proportionals be required, each of which terms is less than 3^h or 3° , it may be computed by proportional logarithms in the same manner as by common logarithms. If one of the terms be 3^h or 3° , its proportional logarithm need not be considered in the operation, since it is equal to 0. Hence appears the use of proportional logarithms in finding Greenwich time from the distance of the moon from the sun or a fixed star. The variation of the distance in 3^h is taken from the Nautical Almanac, and the proportional logarithm of this is subtracted from that of a less variation of distance. The result is the proportional logarithm of the time required for the latter variation.

Table (s), p. 32. *Log Sine to Seconds*.—Since the sines of small arcs change not only very rapidly, but also irregularly, the common method of proportioning for seconds is both troublesome and erroneous. On these accounts it was thought proper to put down the log sines of arcs as far as $50'$ to seconds; the same numbers are the log cosines of arcs from 90° down to $89^{\circ} 10'$ to seconds. If the *log tangent* of a small arc within the limits of the table be wanted, it may easily be found by subtracting the log cosine (Table t) from the log sine (Table s), adding 10 to the index of the log sine.

Table (t), p. 37. *Log Sines, &c.*—An angle is put down in this table at the top and left hand side, if less than half a right angle; and at the bottom and right hand side, if greater than half a right angle; the angles included on the whole being from 0 to a right angle. The angle is put down both in $^{\circ} ' "$ and in h. m. s.; the columns of log sines, log cosines, &c., are marked at the top or bottom; the titles at the top must be used, when the angle is less than 45° , or 3^h ; and at the bottom when greater than 45° , or 3^h .

If an angle be greater than 90° , or 6^h , take it from 180° , or 12^h , and find the log sine, &c., for the remainder.

This table is useful in turning $^\circ ' ''$ into h. m. s. and conversely. If an angle expressed in $^\circ ' ''$ be greater than 90° ; allow 6^h for 90° , and look for the excess above 90° . If an angle in time be greater than 6^h , allow 90° for 6^h , and look for the excess above 6^h .

Table (u), p. 217. *Logarithms of Numbers*.—The first two pages of this table contain the logarithms of numbers from one to a thousand; the other pages contain the logarithms of numbers from 1000 to 9999. To find the logarithm of any given number proceed as follows. If the number do not consist of more than four figures, they may all be found in the column of nat. numbers, and opposite them will be found the decimal part of the logarithm. The index of the logarithm is equal to the number of places, which the first left hand significant figure of the natural number is from the place of units; and it will be positive, if the first significant figure be a whole number or integer, and negative, if it be a decimal fraction. Thus the logarithm of 234 is 2.369216, and that of 0.234 is $\bar{1}.369216$. If the number of figures in the given nat. number exceed four, look for the first four figures, and take out the corresponding logarithm; then look for the 5th figure among the last figures, that is, in the unit places of the nat. numbers which lie in the space of the column, wherein the first four figures have been found. Place the opposite figures in the column of prop. parts under the last figures of the logarithm already taken out, the last figures in each under one another. Then look for the second supernumerary figure, if there be one in the given nat. number, and put the corresponding figures in the prop. parts, (carrying them one place to the right) under the last proportional part written down. Again, look for the third supernumerary figure in the given nat. number, if there be one, and put the corresponding part (carrying them still one place farther to the right) under the last prop. parts put down; and thus go on as far as it may be necessary. Lastly, add all the numbers, as they are put down, together; and take the result, to the nearest sixth place, for the logarithm required (see example in next page).

If any of the supernumerary figures be a cipher, pass over this, but take care to carry the next prop. parts put down, *two* places to the right.

To find from the table the nat. number of a given logarithm, proceed as follows. Look for the decimal part of the given logarithm in the column of logarithms. If this be found exactly, take out the corresponding number from the column of the nat. numbers. Then insert the decimal mark, so that the first significant figure may be as many places from the unit's place as there are units in the index of the given logarithm, to the left or right of the units, according as the index is positive or negative.

If there is not a sufficient number of places in the nat. number, when the index is positive, ciphers must be added to the right.

When the index is negative, put a cipher in the unit's place, and then other ciphers in continuation in the first decimal places, so that the first significant figure may be as far from the units, as is denoted by the index.

When the decimal part of the given logarithm cannot be found exactly, in that case, find in the column of logarithms a number next below the decimal of the given logarithm; and take the difference between this and the said decimal. Look in the column of prop. parts, in the space from which the next less logarithm has been taken, for the number next below this difference; the last figure, that is, the figure in the unit's place, of the nat

number opposite, will be the first figure to be added in continuation to the nat. number corresponding to the next less logarithm.

Take the number in the column of prop. parts next below the aforesaid difference, from the difference itself, and add to the remainder a cipher. With this look again in the column of prop. parts for the number next below it, and the last figure in the nat. number opposite will be the second additional figure.

Thus go on as far as may be necessary, taking the last additional figure to the nearest unit.

If the difference, or remainder with the addition of one cipher, be less than any of the numbers in the column of prop. parts, the corresponding additional figure will be a cipher. Then add another cipher to the remainder, and proceed as above *.

Ex. Required the logarithm of 623472 and the nat. number of the logarithm 5.372642.

dec. log. of 6234...	.794767		5.372642
p. p. for 7	49	next less. ....	.372544. .2358
for 2	14		
		diff.	98
decl. reqd. log. ....	.794817	in prop. parts	92. 5
putting the index	5.794817		—
			60
			55. 3
			—
		Reqd. nat. number to nearest unit. .	235853 50

Table of B (u 2), p. 244.

This table contains the number 6.391030 increased by the difference of the log. cosines of the true altitude and corresponding apparent altitude of the sun or star. This sum, as taken from the table, is useful in particular methods of clearing the lunar distance.

Table (v), p. 248. *Nat. Versines.*—To find the nat. versine of a given arc from this table, look for the degrees and minutes on the left hand page, the degrees at the top and the minutes at the side; and take out the corresponding number, observing that where only the last five figures are put down, the preceding ones printed at every third must be added. Then putting the finger on the right hand page at the nearest half degree to the degrees and minutes just looked out, move it down the corresponding column, till it is opposite to the seconds of the given arc, as seen in either side column. The number where the finger is placed, will be the parts for the seconds, to be added to the number taken from the left hand page, the last figure under the last figure.

To find the arc for any given nat. versine, look for the next less in the left hand page, and take it from the given one. At the same time, take out the degrees and minutes corresponding to the next less. Put your finger on the right hand page at the nearest half degree to the degrees and minutes just taken out, move it down the corresponding column, till you come to the difference between the given versine and the next less as just found, or to

* The index for whole numbers is always *one less* than the No. of integers or whole numbers. When the index is not negative, the No. of integral figures or whole numbers in the nat. number is *one more* than the index denotes.

the nearest number thereto. Then the seconds on either side between which the figure is placed, will be the seconds in the required arc, to be written after the degrees and minutes taken out.

If the minutes of an arc be nearly 15', or 45', in that case, where great accuracy is required, the mean of two parts for seconds may be taken, for the next less half degree and the next greater.

The versines of arcs expressed in time as far as 36^m are given in the three first pages of the table. This part of the table will be found useful, particularly in computing the latitude by several altitudes of a heavenly body taken near the meridian by the following rule.

Take the time of each observation by a time-keeper, the error of which on apparent time is known, and thence deduce the distance in time between each observation and noon, that is, each hour angle in time; take out the nat. versines of these hour angles, and dividing their sum by their number, get the mean versine. Add the corrected or true altitudes together, and dividing by their number get the mean true altitude, and thence the mean true zenith distance. For a Greenwich date corresponding to noon at the place, take from the Nautical Almanac the sun's declination; with this and the mean true zenith distance, as if it were the meridian zenith distance, find an approximate latitude. Then add together 5.314425, log cosine approximate latitude, log cosine declination, log cosec. mean true zenith distance, and log. of the mean nat. versine (adding 4 to proper index). The sum, rejecting the *tens* from the index, will be the log. of a number of seconds, which find from the tables, and subtract them from the mean true zenith distance (under the pole add): the result will be the true meridian zenith distance, from which and the declination, deduce the true latitude as usual.

The *nat. sine* of any angle may be taken from this table, by finding the nat. vers. of an angle greater than the given one by 90°, rejecting the first figure 1. If the angle be above 90°, take the nat. sin. of its supplement to 180°, in this manner. To find the nat. cosine of an angle, take the nat. sine of what it wants, or is above 90°, in the same manner.

Table (w), p. 284. *The correction of the Moon's Altitude and the Auxiliary Angle A.*—The effect of refraction on the moon's altitude being subtracted from the effect of parallax, the remainder is called the *correction in altitude*. To find it from this table, look for the half page having the degree of apparent altitude at the corner; put your finger at the top on the minutes of the horizontal parallax, and move it down the middle line between the column marked *corr.* and the column marked A with 60° under it, till you come opposite the minute at the side nearest to the minute of the apparent altitude in the proper half page. Take out the number at that point to the left of the aforesaid middle line, that is, in the column marked *Corr.* To this add the parts for the seconds of the horizontal parallax taken from the column marked *corr.* at the right hand side of the page. The result will be the correction in altitude which is required.

Should the horizontal parallax be between 53' and 54', then take the correction out for 54', and subtract the parts for the seconds which the horizontal parallax is below 54'. Thus suppose the horizontal parallax is 53' 57'', and the moon's apparent altitude is 18° 16'; then the correction corresponding to 54' of horizontal parallax and the altitude 18° 16' is 48' 23'', and the parts for 3'' at the right hand side of the page is 3'': consequently the correction required is 48' 20''.

This table also contains the auxiliary angle *A*, which is used in clearing the distance by the method given in p. 161 of Navigation. The minutes and seconds, to be added to the 60° at the top, are taken out of the table at the same time with the correction in altitude, and in a similar manner; being found on the right of the middle line under the minutes of the horizontal parallax, and opposite the minutes of altitude, or the nearest number thereto. Two additions are made to the number so taken out, one taken from the column *A* opposite to the seconds of the horizontal parallax in the right hand margin, and the other from the small Table at the bottom of the right hand side of the page, for the nearest degree put down there of the sun or star's altitude; from the second or third column, that is, from the column marked \odot or \star , according as the sun or star is observed.

When the moon's distance from a planet is observed, take the second correction of *A* from the Table (c), p. 2, instead of the column marked \odot or \star .

If the horizontal parallax is below $54'$, the value of *A* corresponding to $54'$ and the apparent altitude must first be taken out; then the parts for the seconds which the horizontal parallax is below $54'$ must be subtracted; and thirdly, the small correction for the sun or star's altitude must be added.

Table (x), p. 327. *Traverse Table*.—This table is used principally in working a day's work. The distance run is looked for at the top, and the corrected course, either in points or in degrees, at the side; if less than four points, or 45° , at the left hand side; if greater than four points, or 45° , at the right hand side. The *diff. lat.* and *dep.* will be found in the columns so marked, in the former case at the top, in the latter at the bottom.

This table is also frequently used in turning *dep.* into *diff. of long.*, by looking for the *mid. lat.* as a *course*, and the *dep.* as a *diff. lat.*; the *dist.* will then be the *diff. long.*, also conversely; if the *mid. lat.* be looked for as a *course*, and the *diff. long.* in the *dist.* column, the *dep.* will be the corresponding number in the *diff. lat.* column.

Table (y), p. 364. *Meridional Parts*.—At the earth's equator a degree of longitude is equal to a degree of latitude in length; but as we approach the poles the degrees of longitude become less and less, while the degrees of latitude (supposing the earth to be a perfect sphere) remain the same. In a Mercator's chart the degrees, minutes, &c. of longitude are made every where of the same length; hence, to keep up their proper proportion, it is necessary to increase the degrees, minutes, &c. of latitude. A formula is investigated, which gives the value of any latitude properly increased for this purpose; and the miles contained in the latitude so increased are called its *meridional parts*. The meridional parts are taken by inspection from this table for any given latitude, entering with the degrees at the top, and with the minutes at the side. For all the common purposes of navigation it will be sufficient to take out the meridional parts to the nearest unit; that is, to the nearest figure before the decimal mark or dot.

Table (z), p. 373. *Bearing Amplitude and Time Amplitude at the Rising and Setting of the Sun*.—By the bearing amplitude of the sun is meant the arc of the horizon intercepted between the east point and the point where the sun rises, or between the west point and the point where it sets. It is reckoned from the east and west points towards the north or south, according as the declination is north or south.

By the time amplitude is meant the time the sun rises before or after

6 A.M., or sets before or after 6 P.M. When the latitude and declination are both north or both south, the sun rises so much before 6 A.M., and sets so much after 6 P.M. When the latitude and declination are one north and the other south, the sun rises so much after 6 A.M., and sets so much before 6 P.M.

Each of these amplitudes is found by entering the table with the nearest degree to the declination at the top, and the nearest degree to the latitude at the side. This will be sufficient for most of the purposes of the table.

Table (z 1), p. 377. *The Time from Noon, at which the True Bearing of the Sun is E. or W.*—The most advantageous time for taking an altitude of the sun at sea, from which apparent time is to be deduced, is when its true bearing is E. or W., provided its altitude above the horizon is then at least 6 or 7 degrees. This time may be known by inspection from the tables, entering it with the nearest degree to the declination at the top, and the nearest degree to the latitude at the side.

Table (z 2), p. 378. *Equation of Second Differences for 12 hours.*—Since the moon's latitude, declination, right ascension, &c. do not vary uniformly for 12 hours, the result of a single proportion will not give the correct change after noon or midnight up to the Greenwich date. The first proportional part therefore is corrected by means of a table of second differences as follows.

To find the moon's correct latitude for any given Greenwich date, take from the Nautical Almanac two latitudes, which immediately precede the given date, and two which immediately follow it; write these in the order of time, under each other, marking each with its proper name N or S. If the second be greater than the first and they have the same name, put down their difference with the name of either; if the second be less than the first, and they have the same name, put down their difference with a name different from that of either; if the two latitudes have different names, put down their sum with the name of the latter. A similar rule must be followed for the second and third latitude, and for the third and fourth. Afterwards take the difference of these first differences in a similar manner, marking the result as directed. Then, if the two results have the same name, take half their sum and give it the name of either; if they have different names, take half their difference, and give it the name of the greater.

Enter the *Table of Second Differences* with the hours and minutes the Greenwich date is after noon or midnight, at the side; and with the mean second difference at the top, first the minutes and then the seconds (see the Table). The sum of the parts taken out will be the *equation of second differences*, to which put a contrary name to that of the mean second difference. Then compute the first proportional part as usual, putting to it the name of the middle first difference; under this put the equation of second differences, and if the names be like, take the sum with the name of either; if the names be unlike, take the difference with the name of the greater; the result will be the correct proportional part to be applied to the second latitude.

The declination of the moon is taken out in a similar manner.

The right ascension of the moon may also be taken out thus: putting to each right ascension the sign + instead of the name N or S as used above and the sign — when the name is changed as above.

This observation applies also to the longitude of the moon

Ex. Required the moon's latitude at Greenwich on May 18, 4^h 20^m.

Latitude.			
17	Midn. . . . 4° 59' 49" S	First Diff.	
18	Noon . . . 5 0 29 S	0' 40" S	
18	Midn. . . . 4 57 32 S	2 57 N	Second Diff.
			3' 37" N
19	Noon . . . 4 50 46 S	6 46 N	M. Second Diff.
		3 49 N	3' 43" S
(p)			
	.44236		1' 3".8 N
	1.78545		0 25 .7 S
	<hr/>		<hr/>
	2.22781		0 38 .1 N
			5 0 29 S
			<hr/>
		Lat.	4 59 50 .9 S

Table (z 3), p. 379. *Mean Motion of the Sun in Right Ascension for Sidereal Hours.*—This table contains the difference between any interval as expressed in sidereal time, and the same interval as expressed in mean solar time. It is particularly useful in turning sidereal time into mean solar time as follows. From sidereal time, increased if necessary by 24 hours, subtract the right ascension of the sun at the preceding apparent noon. The remainder will be the interval between apparent noon and the given instant, as shewn by a sidereal clock. From this subtract the mean increase of the sun's right ascension in that interval so expressed, which increase is taken from this table. The remainder will then be the distance from apparent noon as shewn by a mean solar clock. To this apply the equation of time at the preceding noon with its proper sign as in the Nautical Almanac, and the result will be the distance of the given instant from mean noon, as shewn by a mean solar clock, or it will be mean time.

Table (z 4), p. 379. *Correction of Mean Refraction.*—The amount of refraction depends on the weight and temperature of the air. The barometer at the surface of the sea is supposed to stand at 30 inches and the thermometer at 50°, when the air is at its mean state in both respects. On this supposition the tables of correction for refraction and parallax, pp. 6, 7, 8, 9, and p. 284 to 326, are formed. If the barometer and thermometer do not stand so, the corrections taken from those tables must be increased or diminished by the numbers taken from Table (z 4). When the quicksilver in the barometer is higher than 30 inches, or that in the thermometer is higher than 50°, the number of seconds taken from Table (z 4) must be applied with the signs at the head of the columns, for the sun or a star; when the quicksilver stands below these heights in either, they must be applied with the signs at the bottom, for the sun or a star. But to the correction of the moon's altitude, as put down in Table (w), these numbers must be applied with contrary signs to those found in this manner.

Table (o) 1, p. 12. An imaginary sun moving in right ascension with the mean motion of the true sun, or $3' 56''.556$ in 24 mean solar hours, is called the *mean sun*. When such a supposed sun is on the meridian of any place, its right ascension is the same there as *sidereal time* (see Navigation); under which heading it is put down in the Nautical Almanac for every mean noon at Greenwich.

For any other Greenwich date the numbers taken from this Table—first, for the hours; secondly, for the minutes; and, thirdly, for the seconds—are added to the right ascension (or sidereal time) at the preceding noon. The result is the right ascension of the mean sun for the Greenwich date.

Table (o) 2, p. 12. A diameter of the earth being supposed to be produced outside the earth's surface to any height as h , and a tangent as t to be drawn from the extremity of h to the surface of the sea: then, from the properties of the circle, $t^2 = h \times (\text{diameter} + h)$: or, taking the diameter 4179648 feet, $\log. t = \frac{1}{2} \left\{ \log. h + \log. (41796480 + h) \right\}$. From this formula t is computed for different heights h , and put down in this Table. It is evidently the distance at which a high object, as the top of a mountain whose height is h , might be seen by an eye supposed to be placed on the surface of the sea. If t be supposed to be produced beyond the point where it touches the sea, so as to reach any elevated spot where the eye may actually be placed, as the mast-head of a ship, whose height is h' , the distance it is thus produced, as t' , may evidently be found from the Table by entering it with h' ; and then, adding t' to t , the sum will be the whole distance of the eye from the object whose height is h .

Table (o) 3, p. 12. If δ (computed as in p. xi.) denote the 2nd difference of any quantities put down for every 1^h or 3^h , as the moon's R. A. in the Nautical Almanac or the lunar distances, then the *equation of 2nd diff.*

is $\delta \cdot x \cdot \frac{x-1}{2}$, x being the fractional part of 1^h or 3^h , which the Greenwich date is beyond the preceding 1^h or 3^h . In Table (o) 3 the value of $x \cdot \frac{x-1}{2}$

is put down, so that, if δ in seconds be multiplied by the number found from this Table, the result will be the *equation of 2nd diff.*, by which an element to be computed for any Greenwich date may be corrected, in the manner directed in p. xi., where the interval is 12^h .

When the Greenwich date is required to be found from the given element, this is first computed, as usual, on the supposition of uniform motion for 1^h or 3^h ; the *equation of 2nd diff.* is then computed in the manner pointed out in p. xi. Then subtracting from the *prop. log.* of this equation the *prop. log.* of the excess of the Greenwich date first got above the preceding 1^h or 3^h , the result will be the *prop. log.* of the required correction on account of variable motion. This correction being found, it must be added when the change of the element is accelerated, that is, when the differences of the element in question for 1^h or 3^h increase; otherwise it must be subtracted.

But this correction is most easily taken from a Table in the Nautical Almanac, p. 484.

Table (o) 4, p. 12. If x be the true lunar distance, d the apparent dis-

tance, A and A' the true altitudes, and a and a' the apparent altitudes; then
vers. $x = \text{vers. } (A - A') + \text{vers. } \theta$, where $\log. \text{havens } \theta = \frac{1}{2} \log. \text{havens}$
 $(d + \overline{a - a'}) + \frac{1}{2} \log. \text{havens } (d - \overline{a - a'}) + \{ \log. \text{sec. } a + \log. \cos. A - 20 \} +$
 $\{ \log. \text{sec. } a' + \log. \cos. A' - 20 \}$ Table (o) 4 contains each expression
 between the brackets, supposing the body, as a fixed star, to be affected only
 by refraction (see Navigation, Lunar Observations, when spheroidal figure of
 earth is considered). And the column for the sun contains the expression
 for the sun as affected both by parallax and refraction.

Table of Logistic Logarithms (o) 5. If there be a proportion consist-
 ing of four terms, two of which are expressed in time and two in degrees, or
 all are expressed in time or in degrees, one of the terms being 1^h or 1° , and
 none of them being greater than 1^h or 1° ; then, any one unknown and
 required term may be easily found by means of this Table. Thus, let 1^h
 $: a :: b : c$ be the proportion; then the Table contains what the log. of
 seconds in each term wants of the log. of 3600, the number of seconds in 1^h
 or 1° , and this is called the *logistic logarithm*. (*loge. log.*) of that term. The
loge. log. of 1^h or 1° is therefore 0, and in the proportion just stated, any one of
 the three terms, a, b, c , may be found by adding or subtracting the *loge. log.*
 of the two others supposed known: if the required term be an extreme term,
 as c , by adding: if a mean or middle term, as b or a , by subtracting. The
 result will be the *loge. log.* of the required term, which may be taken, there-
 fore, from the Table.

Table of Prop. Parts, p. 216. A principal use of this Table is to take
 out log. *sin.*, log. *cos.*, &c., for seconds of arc. To do this, take out of the
 Table of log. *sin.*, log. *cos.*, &c., the difference for $15''$ of arc. Look for this
diff. in the left marginal column of this Table of Prop. Parts, under 15; then
 the *diff.* for any odd seconds above the next less $15''$, for which the log. *sin.*,
 log. *cos.*, &c., is given, will be found in the same horizontal line, and under
 the said odd seconds in the extreme heading in a line with 15. In using
 this Table it must be particularly noticed that some of the last figures, under
 the heading 15, may be considered as decimal fractions, in which case, the
 same number of decimal fractions must be supposed in the number taken out.
 Let the log. *sin.* of $12^\circ 33' 23''$ be required. The log. *sin.* of $12^\circ 33' 15''$ is
 9.337185: the *diff.* for $15''$ is 141, the nearest to which under 15 is 140,
 the last 0 in 1400 being considered a decimal fraction. The corresponding
 number under 8 (which $23''$ is above $15''$) is 74.7, where the last figure is
 supposed a decimal fraction. Adding, therefore, 74.7 or 75 to 9.337185,
 we have the required log. *sin.*, namely, 9.337260.... The mode of finding
 an arc to the nearest second, by means of this Table, will be apparent from
 the following example. Let the arc be required corresponding to log. *sin.*
 9.337260. The next in the Table of log. *sines* is 9.337185, which is less
 than the given log. *sine* by 75. Looking for the nearest to 75 in the same
 horizontal line with the *diff.* for $15''$ or 141, considering in both cases the
 last figure as a decimal fraction, we find 8 at the top. Consequently, the re-
 quired arc is $12^\circ 33' 15'' + 8''$, or $12^\circ 33' 23''$.

This Table may be used also in a similar manner, when the prop. part
 is given for 1^h or 60^m ; or for 12^h ($*12^*$), as in the case of the moon's hor
 parallax and semidiameter.

1830

Catalogue of BRIGHT STARS.

(a)

Mag.	Cha.	SITUATION.	NAME.	Right Ascension in Time for 1830.			An. Var. in Right Ascension.	Declination for 1830.		An. Var. in Declination.	
				h.	m.	sec.		°	"		
2	γ	Extremity of the wing of Pegasus	Algenib	0	4	29.6	+3.08	14	14	19 N.	+20.20
2	α	Head of Phoenix		0	17	50.8	+2.98	43	13	12 S.	-20.00
3	α	In Cassiopeia	Schedar	0	30	54.5	+3.31	55	36	14 N.	+19.80
2	β	Tail of the Whale	Deneb kaitos	0	35	2.0	+3.00	18	55	20 S.	-19.84
2	α	Little Bear—POLE STAR	Polaris	0	59	32.1	+15.19	88	24	8 N.	+19.45
2	β	Girdle of Andromeda	Mirach	0	1	11.6	+3.30	34	43	11 N.	+19.41
1		Spring of River Eridan	Achernar	1	31	22.4	+2.24	58	6	8 S.	-18.53
2.3	α	Preceding Horn of Ram	Hamel	1	57	36.5	+3.35	22	39	18 N.	+17.40
2	δ	Neck of the Whale		2	7	45.0	+3.03	3	44	56 S.	-17.04
2	α	Jaw of the Whale	Menkar	2	53	24.1	+3.12	3	25	5 N.	+14.75
2	β	Head of Medusa	Algol	2	57	7.5	+3.85	40	17	43 N.	+14.51
2	α	Inside of Perseus. N. of Algol	Mirfak	3	12	13.7	+4.20	49	14	55 N.	+13.50
1	α	Southern eye of Bull	Aldebaran	4	26	10.5	+3.43	16	9	37 N.	+7.95
1	α	Left shoulder of Auriga	Capella	5	4	8.6	+4.41	45	48	55 N.	+4.57
1	β	Bright foot of Orion	Rigel	5	6	22.3	+2.88	8	24	15 S.	-4.92
2	β	Northern horn of Bull	Nath	5	15	33.2	+3.78	28	27	20 N.	+3.83
2	γ	Western shoulder of Orion	Bellatrix	5	16	1.1	+3.21	6	11	19 N.	+4.01
2	δ	Preceding Star in belt of Orion		5	23	19.6	+3.06	0	25	55 S.	-3.37
2	α	Bright Star in Dove		5	33	30.5	+2.17	34	10	4 S.	-2.44
1	α	Eastern shoulder of Orion	Betelgeuse	5	45	58.3	+3.25	7	22	5 N.	+1.37
1	2 α	Poop of Ship Argo	Canopus	6	20	10.6	+1.33	52	36	16 S.	+1.63
1	α	Mouth of Greater Dog	Sirius	6	37	39.9	+2.61	16	29	20 S.	+4.36
2	δ	Back of Greater Dog		7	1	28.9	+2.44	26	7	45 S.	+5.18
2	η	Tail of Greater Dog		7	17	31.9	+2.37	28	58	34 S.	+6.51
1	α	Head of Northern Twin	Castor	7	23	44.5	+3.85	32	15	12 N.	-7.06
1.2	α	Lesser Dog	Procyon	7	30	24.0	+3.15	5	39	16 N.	-8.54
2	β	Head of Southern Twin	Pollux	7	34	54.2	+3.69	28	25	47 N.	-8.00
2	ζ	Rowlock of Ship Argo		7	57	37.0	+2.11	39	31	35 S.	+9.73
2	γ	Poop of Ship Argo		8	4	28.4	+1.85	46	50	12 S.	+10.25
3	δ	Middle of Ship Argo		8	40	0.9	+1.66	54	4	56 S.	+12.62
1	β	Oars of Ship Argo		9	11	21.2	+0.74	69	1	10 S.	+14.83
2	α	Heart of female Hydra	Alphard	9	19	14.1	+2.95	7	55	31 S.	+15.19
1	α	Lion's Heart	Regulus	9	59	18.7	+3.21	12	47	44 N.	-17.33
2	β	Southern Star in sq. of Great Bear		10	51	30.8	+3.71	57	17	31 N.	-19.09
2	α	Northern, ditto	Dubhe	10	53	9.9	+3.83	62	40	2 N.	-19.30
1.2	β	Lion's Tail	Denebola	11	40	23.0	+3.07	15	31	21 N.	-20.04
2	β	Second Star in the Virgin	Zavijava	11	41	50.5	+3.12	2	43	25 N.	-20.00
2	γ	East Angle of sq. of Great Bear	Phceda	11	44	50.9	+3.20	54	38	25 N.	-20.00
1	α	Foot of the Cross		12	17	13.8	+3.23	62	9	25 S.	+20.00
2	γ	Top of the Cross		12	21	46.6	+3.24	56	9	21 S.	+19.97
2	β	Following arm of the Cross		12	37	50.7	+3.40	58	45	31 S.	+19.81
1	α	Virgin's Spike	Spica	13	16	14.9	+3.14	10	16	13 S.	+18.95
2	η	Last Star in tail of Great Bear	Benetnach	13	40	49.9	+2.38	50	9	53 N.	-18.20
1	β	Western foot of Centaur		13	51	54.5	+4.10	59	32	47 S.	+17.82
3	α	Tail of the Dragon		13	59	47.3	+1.62	65	11	26 N.	-17.42
1	α	Bright Star in Bootes	Arcturus	14	7	54.6	+2.73	20	4	18 N.	-18.99
1	α	Eastern foot of Centaur		14	28	44.5	+4.44	60	8	41 S.	+16.13
2	α	Southern Scale of Libra	Zubenesch	14	41	17.9	+3.29	15	16	58 S.	+15.20
2	2 α	Northern Scale of Libra	Zubenelg	14	41	29.3	+3.29	15	19	44 S.	+15.20
3	β	Shoulder of Little Bear	Kochab	14	51	17.2	-0.32	74	51	1 N.	-14.70
2.3	α	Bright Star in Northern Crown	Alphacca	15	27	29.6	+2.53	27	17	32 N.	-12.49
2	α	Neck of the Serpent	Unukalhay	15	35	54.1	+2.94	6	58	1 N.	-11.73
1	α	Scorpion's Heart	Antares	16	18	59.7	+3.66	26	2	43 S.	+8.62
2.3	α	Head of Hercules	Ras Algethi	17	6	54.0	+2.73	14	35	28 N.	-4.48
2	α	Head of Ophiuchus	Ras Alhagaa	17	27	2.9	+2.77	12	41	28 N.	-3.10
2	γ	Head of the Dragon	Rastaban	17	52	39.7	+1.38	51	30	44 N.	-0.70
1	α	Bright Star in Harp	Vega	18	31	11.1	+2.03	38	37	50 N.	+3.00
3	γ	Preceding Star in the Eagle	Tarazed	19	38	10.7	+2.85	10	12	20 N.	+8.38
1.2	α	Bright Star in Eagle	Atair	19	42	29.4	+2.93	8	25	33 N.	+9.06
3	β	Following Star in Eagle	Alshairn	19	46	57.8	+2.95	5	59	20 N.	+8.57
3	1 α	Northernm. in head of Capricorn		20	8	13.2	+3.33	13	1	33 S.	-10.80
3	2 α	Southernm. in head of Capricorn	Secunda Giedi	20	8	37.0	+3.33	13	3	52 S.	-10.80
1.2	α	Eye of Peacock		20	12	8.5	+4.83	57	16	25 S.	-10.69
1	α	Tail of the Swan	Deneb	20	35	38.4	+2.04	44	40	35 N.	+12.63
1	α	Western shoulder of Cepheus	Alderamin	21	14	31.0	+1.42	61	52	2 N.	+14.90
4	β	Belt of Cepheus	Alphirk	21	26	26.0	+0.81	69	48	56 N.	+15.70
3	α	Eastern shoulder of Aquarius	Sadalmelik	21	57	3.0	+3.09	1	8	30 S.	-17.37
2	α	Western wing of Crane		21	57	27.9	+3.84	47	6	34 S.	-17.14
1.2	α	Mouth of South Fish	Fomalhaut	22	48	14.3	+3.34	30	31	15 S.	-19.10
2	β	Shoulder of Pegasus	Scheat	22	55	30.6	+2.87	27	9	31 N.	+19.21
2	α	Wing of Pegasus	Markab	22	56	18.0	+2.98	14	17	33 N.	+19.43
2	α	Head of Andromeda	Alpheratz	23	59	37.0	+3.08	28	9	6 N.	+19.99

Parallax in Altitude for Planets.

App. Alt.	Horizontal Parallax.															
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
0	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0
3	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0
6	2.0	3.9	5.9	7.9	9.9	11.9	13.9	15.9	17.9	19.9	21.9	23.9	25.9	27.9	29.9	31.8
9	2.0	3.9	5.9	7.9	9.9	11.9	13.8	15.8	17.8	19.8	21.7	23.7	25.7	27.6	29.6	31.6
12	1.9	3.9	5.9	7.8	9.8	11.7	13.7	15.6	17.6	19.6	21.5	23.5	25.4	27.4	29.3	31.3
15	1.9	3.8	5.8	7.7	9.6	11.6	13.5	15.5	17.3	19.3	21.3	23.2	25.1	27.1	29.0	30.9
18	1.9	3.8	5.7	7.6	9.5	11.4	13.3	15.2	17.1	19.0	20.9	22.8	24.7	26.6	28.5	30.4
21	1.9	3.7	5.6	7.5	9.4	11.2	13.0	14.9	16.8	18.7	20.5	22.4	24.2	26.1	28.0	29.9
24	1.8	3.6	5.5	7.3	9.1	11.0	12.8	14.6	16.4	18.2	20.0	21.9	23.7	25.5	27.4	29.2
27	1.8	3.6	5.3	7.1	8.9	10.7	12.5	14.2	16.0	17.8	19.6	21.4	23.1	24.9	26.7	28.5
30	1.7	3.4	5.1	6.9	8.7	10.4	12.1	13.8	15.6	17.3	19.0	20.8	22.5	24.2	26.0	27.7
33	1.7	3.3	5.0	6.7	8.4	10.0	11.7	13.4	15.0	16.8	18.4	20.1	21.8	23.5	25.1	26.8
36	1.6	3.2	4.8	6.4	8.0	9.7	11.3	12.9	14.6	16.2	17.8	19.4	21.0	22.6	24.2	25.9
39	1.5	3.1	4.6	6.2	7.8	9.3	10.8	12.4	14.0	15.5	17.0	18.6	20.2	21.7	23.3	24.9
42	1.5	3.0	4.5	5.9	7.4	8.9	10.4	11.9	13.4	14.9	16.3	17.8	19.3	20.8	22.3	23.8
45	1.4	2.8	4.2	5.6	7.1	8.5	9.9	11.3	12.7	14.1	15.6	16.9	18.4	19.8	21.2	22.6
48	1.3	2.7	4.0	5.3	6.7	8.0	9.3	10.7	12.0	13.4	14.7	16.1	17.4	18.7	20.1	21.4
51	1.2	2.5	3.8	5.0	6.2	7.6	8.8	10.1	11.3	12.6	13.8	15.1	16.4	17.6	18.9	20.1
54	1.1	2.3	3.5	4.7	5.9	7.1	8.2	9.4	10.5	11.7	12.9	14.1	15.3	16.4	17.6	18.8
57	1.1	2.1	3.3	4.3	5.4	6.5	7.6	8.7	9.8	10.9	12.0	13.1	14.1	15.2	16.3	17.4
60	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0
65	0.8	1.7	2.5	3.4	4.2	5.1	5.9	6.7	7.6	8.4	9.3	10.1	11.0	11.8	12.7	13.5
70	0.7	1.4	2.1	2.7	3.4	4.1	4.8	5.5	6.1	6.8	7.5	8.2	8.9	9.6	10.3	10.9
75	0.5	1.0	1.5	2.1	2.6	3.1	3.6	4.1	4.6	5.1	5.7	6.2	6.7	7.2	7.8	8.3
80	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.5	4.8	5.2	5.5
85	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(c) Correction of A. for Planet in clearing Distance.

[illegible]

Name of Point.		Points	In Degrees	Log. Sine.	Name of Point.		(d)
NORTH.			° ' "		SOUTH.		
N. $\frac{1}{4}$ E.	N. $\frac{1}{4}$ W.	$\frac{1}{4}$	2 48 45	8.690796	S. $\frac{1}{4}$ E.	S. $\frac{1}{4}$ W.	
N. $\frac{1}{2}$ E.	N. $\frac{1}{2}$ W.	$\frac{1}{2}$	5 37 30	8.991302	S. $\frac{1}{2}$ E.	S. $\frac{1}{2}$ W.	
N. $\frac{3}{4}$ E.	N. $\frac{3}{4}$ W.	$\frac{3}{4}$	8 26 15	9.166520	S. $\frac{3}{4}$ E.	S. $\frac{3}{4}$ W.	
N. by E.	N. by W.	1	11 15 0	9.290236	S. by E.	S. by W.	
N. by E. $\frac{1}{4}$ E.	N. by W. $\frac{1}{4}$ W.	1 $\frac{1}{4}$	14 3 45	9.385571	S. by E. $\frac{1}{4}$ E.	S. by W. $\frac{1}{4}$ W.	
N. by E. $\frac{1}{2}$ E.	N. by W. $\frac{1}{2}$ W.	1 $\frac{1}{2}$	16 52 30	9.462824	S. by E. $\frac{1}{2}$ E.	S. by W. $\frac{1}{2}$ W.	
N. by E. $\frac{3}{4}$ E.	N. by W. $\frac{3}{4}$ W.	1 $\frac{3}{4}$	19 41 15	9.527488	S. by E. $\frac{3}{4}$ E.	S. by W. $\frac{3}{4}$ W.	
N.N.E.	N.N.W.	2	22 30 0	9.582340	S.S.E.	S.S.W.	
N.N.E. $\frac{1}{4}$ E.	N.N.W. $\frac{1}{4}$ W.	2 $\frac{1}{4}$	25 18 45	9.630992	S.S.E. $\frac{1}{4}$ E.	S.S.W. $\frac{1}{4}$ W.	
N.N.E. $\frac{1}{2}$ E.	N.N.W. $\frac{1}{2}$ W.	2 $\frac{1}{2}$	28 7 30	9.673387	S.S.E. $\frac{1}{2}$ E.	S.S.W. $\frac{1}{2}$ W.	
N.N.E. $\frac{3}{4}$ E.	N.N.W. $\frac{3}{4}$ W.	2 $\frac{3}{4}$	30 56 15	9.711050	S.S.E. $\frac{3}{4}$ E.	S.S.W. $\frac{3}{4}$ W.	
N.E. by N.	N.W. by N.	3	33 45 0	9.744739	S.E. by S.	S.W. by S.	
N.E. by N. $\frac{1}{4}$ E.	N.W. b. N. $\frac{1}{4}$ W.	3 $\frac{1}{4}$	36 33 45	9.775027	S.E. by S. $\frac{1}{4}$ E.	S.W. by S. $\frac{1}{4}$ W.	
N.E. by N. $\frac{1}{2}$ E.	N.W. b. N. $\frac{1}{2}$ W.	3 $\frac{1}{2}$	39 22 30	9.802359	S.E. by S. $\frac{1}{2}$ E.	S.W. by S. $\frac{1}{2}$ W.	
N.E. by N. $\frac{3}{4}$ E.	N.W. b. N. $\frac{3}{4}$ W.	3 $\frac{3}{4}$	42 11 15	9.827084	S.E. by S. $\frac{3}{4}$ E.	S.W. by S. $\frac{3}{4}$ W.	
N.E.	N.W.	4	45 0 0	9.849485	S.E.	S.W.	
N.E. $\frac{1}{4}$ E.	N.W. $\frac{1}{4}$ W.	4 $\frac{1}{4}$	47 48 45	9.869790	S.E. $\frac{1}{4}$ E.	S.W. $\frac{1}{4}$ W.	
N.E. $\frac{1}{2}$ E.	N.W. $\frac{1}{2}$ W.	4 $\frac{1}{2}$	50 37 30	9.881185	S.E. $\frac{1}{2}$ E.	S.W. $\frac{1}{2}$ W.	
N.E. $\frac{3}{4}$ E.	N.W. $\frac{3}{4}$ W.	4 $\frac{3}{4}$	53 26 15	9.904828	S.E. $\frac{3}{4}$ E.	S.W. $\frac{3}{4}$ W.	
N.E. by E.	N.W. by W.	5	56 15 0	9.919846	S.E. by E.	S.W. by W.	
N.E. by E. $\frac{1}{4}$ E.	N.W. b. W. $\frac{1}{4}$ W.	5 $\frac{1}{4}$	59 3 45	9.933350	S.E. by E. $\frac{1}{4}$ E.	S.W. by W. $\frac{1}{4}$ W.	
N.E. by E. $\frac{1}{2}$ E.	N.W. b. W. $\frac{1}{2}$ W.	5 $\frac{1}{2}$	61 52 30	9.945430	S.E. by E. $\frac{1}{2}$ E.	S.W. by W. $\frac{1}{2}$ W.	
N.E. by E. $\frac{3}{4}$ E.	N.W. b. W. $\frac{3}{4}$ W.	5 $\frac{3}{4}$	64 41 15	9.956163	S.E. by E. $\frac{3}{4}$ E.	S.W. by W. $\frac{3}{4}$ W.	
E.N.E.	W.N.W.	6	67 30 0	9.965615	E.S.E.	W.S.W.	
E. by N. $\frac{1}{4}$ N.	W. by N. $\frac{1}{4}$ N.	6 $\frac{1}{4}$	70 18 45	9.973841	E. by S. $\frac{1}{4}$ S.	W. by S. $\frac{1}{4}$ S.	
E. by N. $\frac{1}{2}$ N.	W. by N. $\frac{1}{2}$ N.	6 $\frac{1}{2}$	73 7 30	9.980885	E. by S. $\frac{1}{2}$ S.	W. by S. $\frac{1}{2}$ S.	
E. by N. $\frac{3}{4}$ N.	W. by N. $\frac{3}{4}$ N.	6 $\frac{3}{4}$	75 56 15	9.986786	E. by S. $\frac{3}{4}$ S.	W. by S. $\frac{3}{4}$ S.	
E. by N.	W. by N.	7	78 45 0	9.991574	E. by S.	W. by S.	
E. $\frac{1}{4}$ N.	W. $\frac{1}{4}$ N.	7 $\frac{1}{4}$	81 33 45	9.995274	E. $\frac{1}{4}$ S.	W. $\frac{1}{4}$ S.	
E. $\frac{1}{2}$ N.	W. $\frac{1}{2}$ N.	7 $\frac{1}{2}$	84 22 30	9.997904	E. $\frac{1}{2}$ S.	W. $\frac{1}{2}$ S.	
E. $\frac{3}{4}$ N.	W. $\frac{3}{4}$ N.	7 $\frac{3}{4}$	87 11 15	9.999477	E. $\frac{3}{4}$ S.	W. $\frac{3}{4}$ S.	

(e) Dip of the Sea Horizon.										Dip of a Shore Horizon. (f)													
Height of eye.	Dip.		Height of eye.	Dip.		Height of eye.	Dip.		Height of eye.	Dip.		Height of eye.	Dip.		Distance of the Shore.	Height of the eye above the Sea in feet.							
ft.	'	"	ft.	'	"	ft.	'	"	ft.	'	"	ft.	'	"		Miles	5	10	15	20	25	30	35	40
1	0	59	15	3	49	29	5	18	59	7	34	110	10	19									
2	1	24	16	3	56	30	5	24	62	7	45	120	10	47	$\frac{1}{4}$	11	22	34	45	56	68	79	90
3	1	42	17	4	4	31	5	29	65	7	56	130	11	14	$\frac{1}{2}$	6	11	17	22	28	34	39	45
4	1	58	18	4	11	32	5	34	68	8	7	140	11	39	$\frac{3}{4}$	4	8	12	15	19	23	27	30
5	2	12	19	4	17	33	5	39	71	8	18	150	12	3	1	4	6	9	12	15	17	20	23
6	2	25	20	4	24	34	5	44	74	8	28	160	12	27	$1\frac{1}{4}$	3	5	7	9	12	14	16	19
7	2	36	21	4	31	35	5	49	77	8	38	170	12	50	$1\frac{1}{2}$	3	4	6	8	10	12	14	15
8	2	47	22	4	37	38	6	4	80	8	48	180	13	12	2	2	3	5	6	8	10	11	12
9	2	57	23	4	43	41	6	18	83	8	58	190	13	33	$2\frac{1}{2}$	2	3	5	6	7	8	9	10
10	3	7	24	4	49	44	6	32	86	9	8	200	13	55	3	2	3	4	5	6	7	8	8
11	3	16	25	4	55	47	6	45	89	9	17	210	14	16	$3\frac{1}{2}$	2	3	4	5	6	6	7	7
12	3	25	26	5	1	50	6	58	92	9	26	220	14	36	4	2	3	4	4	5	6	7	7
13	3	33	27	5	7	53	7	10	95	9	36	230	14	56	5	2	3	4	4	5	5	6	6
14	3	41	28	5	13	56	7	22	98	9	45	240	15	15	6	2	3	4	4	5	5	6	6

Augmentation of the Moon's Hor. (g) Semidiameter.								Reduction of Hor. Par., and Lat. of Place, for Figure of Earth; both subtractive. (h)							
App. Alt.	" 14 40	" 15 0	" 15 20	" 15 40	" 16 0	" 16 20	" 16 40	Lat.	54'	56'	58'	60'	62'	Red. of Lat.	
0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0	0.1	0.1	0.1	0.1	0.1	2 15	
6	1.5	1.6	1.7	1.8	1.9	2.0	2.0	12	0.4	0.4	0.4	0.5	0.5	4 24	
8	2.0	2.1	2.2	2.3	2.4	2.5	2.6	18	0.9	1.0	1.0	1.1	1.1	6 22	
10	2.6	2.7	2.8	2.9	3.0	3.1	3.3	24	1.6	1.7	1.8	1.9	1.9	8 3	
12	3.2	3.3	3.3	3.4	3.6	3.7	3.9	30	2.5	2.6	2.7	2.8	2.9	9 23	
14	3.5	3.6	3.8	3.9	4.1	4.3	4.5	36	3.5	3.6	3.7	3.9	4.0	10 19	
16	3.9	4.1	4.3	4.5	4.7	4.9	5.1	42	4.5	4.7	4.9	5.1	5.2	10 48	
18	4.4	4.6	4.8	5.0	5.2	5.4	5.6	48	5.6	5.8	6.0	6.2	6.4	10 48	
20	4.8	5.0	5.3	5.6	5.8	6.0	6.2	54	6.6	6.9	7.1	7.4	7.6	10 20	
22	5.2	5.5	5.8	6.1	6.3	6.6	6.8	60	7.6	7.9	8.2	8.5	8.7	9 25	
24	5.7	6.0	6.3	6.6	6.8	7.1	7.4	66	8.5	8.8	9.1	9.4	9.7	8 5	
26	6.1	6.4	6.8	7.1	7.4	7.7	8.0	72	9.2	9.5	9.9	10.2	10.6	6 24	
28	6.6	6.9	7.2	7.6	7.9	8.2	8.5	78	9.7	10.1	10.5	10.8	11.2	4 26	
30	7.1	7.4	7.7	8.0	8.4	8.7	9.0	84	10.1	10.4	10.8	11.2	11.6	2 16	
32	7.5	7.8	8.2	8.5	8.9	9.2	9.6	90	10.2	10.6	11.0	11.3	11.7	0 0	
34	7.8	8.2	8.6	9.0	9.3	9.7	10.1								
36	8.2	8.6	9.0	9.4	9.9	10.2	10.6								
38	8.6	9.0	9.4	9.9	10.3	10.7	11.1								
40	9.0	9.4	9.8	10.3	10.7	11.1	11.6								
42	9.4	9.8	10.2	10.7	11.2	11.6	12.1								
44	9.8	10.2	10.6	11.1	11.6	12.0	12.6								
46	10.0	10.5	11.0	11.5	12.0	12.5	13.0								
48	10.4	10.9	11.4	11.9	12.4	12.9	13.4								
50	10.7	11.2	11.7	12.2	12.8	13.3	13.8								
52	11.0	11.5	12.0	12.6	13.1	13.7	14.2								
54	11.3	11.8	12.4	12.9	13.5	14.1	14.6								
56	11.6	12.1	12.7	13.2	13.8	14.4	14.9								
58	11.8	12.4	12.9	13.6	14.2	14.7	15.3								
60	12.1	12.7	13.2	13.8	14.5	15.0	15.6								
62	12.3	12.9	13.5	14.1	14.7	15.3	15.9								
64	12.5	13.1	13.7	14.3	15.0	15.6	16.2								
66	12.8	13.4	13.9	14.6	15.2	15.8	16.5								
68	12.9	13.5	14.2	14.8	15.4	16.1	16.7								
70	13.1	13.7	14.4	15.0	15.7	16.3	16.9								
72	13.3	13.9	14												

Diff. Moon's Mer. Pass.	Correction in finding MOON'S Meridian Passage. (k)																							
	Long. (W. add) — (E. Subtract.)																							
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
40	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10	11	11	12	12	13	13
44	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9	9	10	10	11	12	12	13	13	14
48	1	1	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10	11	11	12	13	13	14	15
52	1	1	2	3	4	4	5	5	6	6	7	7	8	8	9	9	10	11	12	12	13	14	14	15
56	1	2	2	3	4	5	5	6	7	7	8	8	9	9	10	11	12	12	13	14	15	16	16	17
60	1	2	2	3	4	5	6	6	7	7	8	9	9	10	11	12	12	13	14	15	16	17	17	18
64	1	2	3	4	4	5	6	7	7	8	9	10	11	12	12	13	14	15	16	17	18	19	20	20
66	1	2	3	4	5	5	6	7	8	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Correction in finding Time of High Water.

(l)

Time of Moon's Mer. Passage.			Moon's Semidiameter.									
			14 30	14 45	15 0	15 15	15 30	15 45	16 0	16 15	16 30	
h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	
0 0	12 0	-0 4	-0 3	-0 2	-0 1	-0 0	+0 1	+0 2	+0 3	+0 5		
0 20	12 20	-0 8	-0 8	-0 7	-0 6	-0 5	-0 4	-0 3	-0 2	-0 1		
0 40	12 40	-0 12	-0 12	-0 11	-0 10	-0 10	-0 10	-0 9	-0 9	-0 8		
1 0	13 0	-0 17	-0 17	-0 17	-0 16	-0 16	-0 16	-0 15	-0 15	-0 15		
1 20	13 20	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22		
1 40	13 40	-0 27	-0 27	-0 27	-0 28	-0 28	-0 28	-0 29	-0 29	-0 29		
2 0	14 0	-0 31	-0 31	-0 32	-0 32	-0 33	-0 33	-0 34	-0 35	-0 36		
2 20	14 20	-0 36	-0 36	-0 37	-0 38	-0 39	-0 40	-0 41	-0 42	-0 43		
2 40	14 40	-0 40	-0 41	-0 42	-0 43	-0 44	-0 45	-0 46	-0 47	-0 49		
3 0	15 0	-0 44	-0 45	-0 47	-0 48	-0 49	-0 51	-0 52	-0 54	-0 56		
3 20	15 20	-0 48	-0 49	-0 51	-0 52	-0 53	-0 55	-0 57	-0 59	-1 1		
3 40	15 40	-0 51	-0 53	-0 55	-0 57	-0 58	-1 0	-1 2	-1 4	-1 7		
4 0	16 0	-0 55	-0 57	-0 59	-1 0	-1 2	-1 5	-1 7	-1 10	-1 12		
4 20	16 20	-0 57	-0 59	-1 0	-1 2	-1 4	-1 6	-1 9	-1 12	-1 15		
4 40	16 40	-0 59	-1 1	-1 3	-1 5	-1 7	-1 9	-1 12	-1 15	-1 18		
5 0	17 0	-1 0	-1 2	-1 4	-1 6	-1 8	-1 10	-1 13	-1 16	-1 19		
5 20	17 20	-1 0	-1 2	-1 4	-1 6	-1 8	-1 11	-1 14	-1 17	-1 20		
5 40	17 40	-0 58	-1 0	-1 2	-1 4	-1 6	-1 8	-1 11	-1 13	-1 16		
6 0	18 0	-0 55	-0 56	-0 58	-1 0	-1 2	-1 4	-1 6	-1 9	-1 12		
6 20	18 20	-0 49	-0 50	-0 51	-0 52	-0 54	-0 56	-0 58	-1 0	-1 3		
6 40	18 40	-0 43	-0 44	-0 45	-0 46	-0 47	-0 48	-0 49	-0 51	-0 53		
6 50	18 50	-0 37	-0 37	-0 38	-0 39	-0 40	-0 41	-0 42	-0 43	-0 45		
7 0	19 0	-0 32	-0 32	-0 33	-0 33	-0 34	-0 34	-0 35	-0 36	-0 37		
7 10	19 10	-0 27	-0 27	-0 27	-0 27	-0 28	-0 28	-0 28	-0 29	-0 29		
7 20	19 20	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22	-0 22		
7 30	19 30	-0 16	-0 16	-0 16	-0 15	-0 15	-0 15	-0 14	-0 14	-0 14		
7 40	19 40	-0 11	-0 11	-0 10	-0 10	-0 9	-0 9	-0 8	-0 7	-0 6		
7 50	19 50	-0 6	-0 6	-0 5	-0 4	-0 3	-0 2	-0 1	-0 0	+0 2		
8 0	20 0	-0 1	-0 0	+0 1	+0 2	+0 3	+0 4	+0 6	+0 7	+0 9		
8 20	20 20	+0 5	+0 6	+0 7	+0 9	+0 11	+0 13	+0 15	+0 17	+0 19		
8 40	20 40	+0 11	+0 12	+0 14	+0 16	+0 18	+0 20	+0 22	+0 25	+0 28		
9 0	21 0	+0 14	+0 16	+0 18	+0 20	+0 22	+0 24	+0 26	+0 29	+0 32		
9 20	21 20	+0 16	+0 18	+0 20	+0 22	+0 24	+0 27	+0 30	+0 33	+0 36		
10 0	22 0	+0 15	+0 17	+0 19	+0 21	+0 23	+0 25	+0 27	+0 30	+0 34		
10 20	22 20	+0 13	+0 15	+0 17	+0 19	+0 21	+0 23	+0 25	+0 28	+0 31		
10 40	22 40	+0 11	+0 13	+0 14	+0 16	+0 18	+0 20	+0 22	+0 25	+0 28		
11 0	23 0	+0 7	+0 8	+0 10	+0 12	+0 14	+0 16	+0 18	+0 20	+0 23		
11 20	23 20	+0 4	+0 5	+0 6	+0 7	+0 9	+0 11	+0 13	+0 15	+0 17		
11 40	23 40	+0 0	+0 1	+0 2	+0 3	+0 5	+0 7	+0 8	+0 10	+0 12		
12 0	24 0	-0 4	-0 3	-0 2	-0 1	-0 0	+0 1	+0 2	+0 3	+0 5		

(Ther. 50.)

(Bar. 30.)

Correction of the SUN's App. Alt. (*subtr.*)

☉

(m)

(or Refraction — Parallax.)

AA	Corr.	Diff.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.
—	—	for 10'	—	—	—	—	—	—	—	—	—	—
0 0	33 42	117	5 0	9 49	6 0	8 23	7 0	7 18	8 0	6 26	9 0	5 45
0 5	32 44	113	5 1	9 43	6 1	8 22	7 1	7 17	8 1	6 25	9 2	5 44
0 10	31 48	109	5 2	9 46	6 2	8 21	7 2	7 16	8 2	6 25	9 4	5 42
0 15	30 56	105	5 3	9 44	6 3	8 20	7 3	7 15	8 3	6 24	9 6	5 41
0 20	30 4	101	5 4	9 43	6 4	8 18	7 4	7 14	8 4	6 23	9 8	5 40
0 25	29 15	97	5 5	9 41	6 5	8 17	7 5	7 13	8 5	6 23	9 10	5 38
0 30	28 28	94	5 6	9 40	6 6	8 16	7 6	7 12	8 6	6 22	9 12	5 37
0 35	27 42	90	5 7	9 38	6 7	8 15	7 7	7 11	8 7	6 21	9 14	5 36
0 40	26 57	87	5 8	9 36	6 8	8 14	7 8	7 10	8 8	6 21	9 16	5 35
0 45	26 15	84	5 9	9 35	6 9	8 13	7 9	7 9	8 9	6 20	9 18	5 33
0 50	25 34	80	5 10	9 33	6 10	8 11	7 10	7 8	8 10	6 19	9 20	5 32
0 55	24 54	77	5 11	9 32	6 11	8 10	7 11	7 7	8 11	6 19	9 22	5 31
1 0	24 16	74	5 12	9 31	6 12	8 9	7 12	7 6	8 12	6 18	9 24	5 30
1 5	23 39	71	5 13	9 29	6 13	8 8	7 13	7 6	8 13	6 17	9 26	5 29
1 10	23 4	69	5 14	9 27	6 14	8 7	7 14	7 5	8 14	6 16	9 28	5 28
1 15	22 31	66	5 15	9 26	6 15	8 6	7 15	7 4	8 15	6 16	9 30	5 27
1 20	21 59	63	5 16	9 24	6 16	8 5	7 16	7 3	8 16	6 15	9 32	5 26
1 25	21 28	61	5 17	9 23	6 17	8 4	7 17	7 2	8 17	6 14	9 34	5 25
1 30	20 58	59	5 18	9 21	6 18	8 2	7 18	7 1	8 18	6 14	9 36	5 24
1 35	20 29	57	5 19	9 20	6 19	8 1	7 19	7 0	8 19	6 13	9 38	5 22
1 40	20 1	55	5 20	9 18	6 20	8 0	7 20	6 59	8 20	6 12	9 40	5 21
1 45	19 34	53	5 21	9 17	6 21	7 59	7 21	6 58	8 21	6 12	9 42	5 20
1 50	19 8	51	5 22	9 15	6 22	7 58	7 22	6 57	8 22	6 11	9 44	5 19
1 55	18 43	49	5 23	9 13	6 23	7 57	7 23	6 57	8 23	6 10	9 46	5 18
2 0	18 20	48	5 24	9 12	6 24	7 56	7 24	6 56	8 24	6 9	9 48	5 17
2 5	17 56	46	5 25	9 10	6 25	7 55	7 25	6 55	8 25	6 9	9 50	5 16
2 10	17 34	44	5 26	9 9	6 26	7 54	7 26	6 54	8 26	6 8	9 52	5 15
2 15	17 12	43	5 27	9 7	6 27	7 53	7 27	6 53	8 27	6 7	9 54	5 14
2 20	16 51	41	5 28	9 5	6 28	7 51	7 28	6 52	8 28	6 7	9 56	5 13
2 25	16 31	40	5 29	9 4	6 29	7 50	7 29	6 51	8 29	6 6	9 58	5 12
2 30	16 12	39	5 30	9 2	6 30	7 49	7 30	6 50	8 30	6 5	10 0	5 11
2 35	15 53	37	5 31	9 1	6 31	7 48	7 31	6 49	8 31	6 5	10 2	5 10
2 40	15 34	36	5 32	9 0	6 32	7 47	7 32	6 48	8 32	6 4	10 4	5 9
2 45	15 16	35	5 33	8 58	6 33	7 46	7 33	6 48	8 33	6 3	10 6	5 8
2 50	14 59	34	5 34	8 57	6 34	7 45	7 34	6 47	8 34	6 2	10 8	5 7
2 55	14 42	33	5 35	8 56	6 35	7 44	7 35	6 46	8 35	6 2	10 10	5 6
3 0	14 26	32	5 36	8 54	6 36	7 43	7 36	6 45	8 36	6 1	10 12	5 5
3 5	14 10	31	5 37	8 53	6 37	7 42	7 37	6 45	8 37	6 0	10 14	5 4
3 10	13 55	30	5 38	8 52	6 38	7 40	7 38	6 44	8 38	6 0	10 16	5 3
3 15	13 41	29	5 39	8 51	6 39	7 39	7 39	6 43	8 39	5 59	10 18	5 2
3 20	13 26	28	5 40	8 49	6 40	7 38	7 40	6 42	8 40	5 58	10 20	5 1
3 25	13 12	27	5 41	8 48	6 41	7 37	7 41	6 41	8 41	5 58	10 22	5 0
3 30	12 58	27	5 42	8 47	6 42	7 36	7 42	6 41	8 42	5 57	10 24	4 59
3 35	12 44	26	5 43	8 45	6 43	7 35	7 43	6 40	8 43	5 56	10 26	4 58
3 40	12 32	25	5 44	8 44	6 44	7 34	7 44	6 39	8 44	5 55	10 28	4 57
3 45	12 19	24	5 45	8 43	6 45	7 33	7 45	6 38	8 45	5 55	10 30	4 56
3 50	12 7	24	5 46	8 41	6 46	7 32	7 46	6 37	8 46	5 54	10 32	4 55
3 55	11 54	23	5 47	8 40	6 47	7 31	7 47	6 37	8 47	5 53	10 34	4 54
4 0	11 43	22	5 48	8 39	6 48	7 30	7 48	6 36	8 48	5 53	10 36	4 53
4 5	11 37	21	5 49	8 38	6 49	7 29	7 49	6 35	8 49	5 52	10 38	4 52
4 10	11 21	20	5 50	8 36	6 50	7 28	7 50	6 34	8 50	5 51	10 40	4 51
4 15	11 11	20	5 51	8 35	6 51	7 27	7 51	6 33	8 51	5 51	10 42	4 50
4 20	11 1	20	5 52	8 34	6 52	7 26	7 52	6 33	8 52	5 50	10 44	4 50
4 25	10 51	19	5 53	8 32	6 53	7 25	7 53	6 32	8 53	5 49	10 46	4 49
4 30	10 41	18	5 54	8 31	6 54	7 24	7 54	6 31	8 54	5 49	10 48	4 48
4 35	10 32	18	5 55	8 30	6 55	7 23	7 55	6 30	8 55	5 48	10 50	4 47
4 40	10 23	17	5 56	8 28	6 56	7 22	7 56	6 29	8 56	5 48	10 52	4 46
4 45	10 15	17	5 57	8 27	6 57	7 21	7 57	6 29	8 57	5 47	10 54	4 45
4 50	10 6	17	5 58	8 26	6 58	7 20	7 58	6 28	8 58	5 46	10 56	4 44
4 55	9 58	16	5 59	8 25	6 59	7 19	7 59	6 27	8 59	5 46	10 58	4 43

(Ther. 50.)

(Bar. 30.)

☉ Correction of the SUN's App. Alt. (*subtr.*)
(or Refraction — Parallax.) (m)

AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.
11 0	4 42	13 0	3 59	15 0	3 26	20 0	2 30	30 0	1 33	50 0	0 43
11 2	4 42	13 2	3 58	15 5	3 25	20 10	2 29	30 20	1 32	50 30	0 42
11 4	4 41	13 4	3 58	15 10	3 23	20 20	2 28	30 40	1 30	51 0	0 42
11 6	4 40	13 6	3 57	15 15	3 22	20 30	2 26	31 0	1 29	51 30	0 41
11 8	4 39	13 8	3 56	15 20	3 21	20 40	2 25	31 20	1 28	52 0	0 40
11 10	4 38	13 10	3 56	15 25	3 20	20 50	2 23	31 40	1 27	52 30	0 39
11 12	4 38	13 12	3 55	15 30	3 19	21 0	2 22	32 0	1 25	53 0	0 38
11 14	4 37	13 14	3 55	15 35	3 18	21 10	2 21	32 20	1 24	53 30	0 38
11 16	4 36	13 16	3 54	15 40	3 17	21 20	2 20	32 40	1 23	54 0	0 37
11 18	4 35	13 18	3 53	15 45	3 15	21 30	2 19	33 0	1 22	54 30	0 36
11 20	4 34	13 20	3 53	15 50	3 14	21 40	2 17	33 20	1 21	55 0	0 36
11 22	4 34	13 22	3 52	15 55	3 13	21 50	2 16	33 40	1 20	55 30	0 35
11 24	4 33	13 24	3 52	16 0	3 12	22 0	2 15	34 0	1 19	56 0	0 34
11 26	4 32	13 26	3 51	16 5	3 11	22 10	2 14	34 20	1 18	56 30	0 33
11 28	4 31	13 28	3 50	16 10	3 10	22 20	2 13	34 40	1 17	57 0	0 33
11 30	4 30	13 30	3 50	16 15	3 9	22 30	2 12	35 0	1 16	57 30	0 32
11 32	4 30	13 32	3 49	16 20	3 8	22 40	2 11	35 20	1 15	58 0	0 32
11 34	4 29	13 34	3 49	16 25	3 7	22 50	2 9	35 40	1 14	58 30	0 31
11 36	4 28	13 36	3 48	16 30	3 6	23 0	2 8	36 0	1 13	59 0	0 30
11 38	4 27	13 38	3 48	16 35	3 5	23 10	2 7	36 20	1 12	59 30	0 30
11 40	4 26	13 40	3 47	16 40	3 4	23 20	2 6	36 40	1 11	60 0	0 29
11 42	4 26	13 42	3 46	16 45	3 3	23 30	2 5	37 0	1 10	60 30	0 28
11 44	4 25	13 44	3 46	16 50	3 2	23 40	2 4	37 20	1 9	61 0	0 28
11 46	4 24	13 46	3 45	16 55	3 1	23 50	2 3	37 40	1 8	61 30	0 27
11 48	4 23	13 48	3 45	17 0	3 0	24 0	2 2	38 0	1 7	62 0	0 27
11 50	4 22	13 50	3 44	17 5	2 59	24 10	2 1	38 20	1 7	62 30	0 26
11 52	4 22	13 52	3 44	17 10	2 58	24 20	2 0	38 40	1 6	63 0	0 26
11 54	4 21	13 54	3 43	17 15	2 57	24 30	1 59	39 0	1 5	63 30	0 25
11 56	4 21	13 56	3 42	17 20	2 56	24 40	1 58	39 20	1 4	64 0	0 24
11 58	4 20	13 58	3 42	17 25	2 55	24 50	1 57	39 40	1 3	64 30	0 24
12 0	4 19	14 0	3 41	17 30	2 54	25 0	1 56	40 0	1 3	65 0	0 23
12 2	4 19	14 2	3 41	17 35	2 54	25 10	1 55	40 20	1 2	65 30	0 23
12 4	4 18	14 4	3 40	17 40	2 53	25 20	1 54	40 40	1 1	66 0	0 22
12 6	4 17	14 6	3 40	17 45	2 52	25 30	1 54	41 0	1 0	66 30	0 22
12 8	4 16	14 8	3 39	17 50	2 51	25 40	1 53	41 20	0 59	67 0	0 21
12 10	4 16	14 10	3 39	17 55	2 50	25 50	1 52	41 40	0 59	67 30	0 21
12 12	4 15	14 12	3 38	18 0	2 49	26 0	1 51	42 0	0 58	68 0	0 20
12 14	4 14	14 14	3 38	18 5	2 48	26 10	1 50	42 20	0 57	69 0	0 19
12 16	4 14	14 16	3 37	18 10	2 47	26 20	1 49	42 40	0 57	70 0	0 18
12 18	4 13	14 18	3 36	18 15	2 47	26 30	1 48	43 0	0 56	71 0	0 17
12 20	4 12	14 20	3 36	18 20	2 46	26 40	1 48	43 20	0 55	72 0	0 16
12 22	4 11	14 22	3 35	18 25	2 45	26 50	1 47	43 40	0 55	73 0	0 15
12 24	4 11	14 24	3 35	18 30	2 44	27 0	1 46	44 0	0 54	74 0	0 14
12 26	4 10	14 26	3 34	18 35	2 43	27 10	1 45	44 20	0 53	75 0	0 13
12 28	4 9	14 28	3 34	18 40	2 43	27 20	1 44	44 40	0 53	76 0	0 12
12 30	4 9	14 30	3 33	18 45	2 42	27 30	1 44	45 0	0 52	77 0	0 11
12 32	4 8	14 32	3 33	18 50	2 41	27 40	1 43	45 20	0 51	78 0	0 10
12 34	4 7	14 34	3 32	18 55	2 40	27 50	1 42	45 40	0 51	79 0	0 9
12 36	4 7	14 36	3 32	19 0	2 39	28 0	1 41	46 0	0 50	80 0	0 9
12 38	4 6	14 38	3 31	19 5	2 39	28 10	1 41	46 20	0 49	81 0	0 8
12 40	4 5	14 40	3 31	19 10	2 38	28 20	1 40	46 40	0 49	82 0	0 7
12 42	4 5	14 42	3 30	19 15	2 37	28 30	1 39	47 0	0 48	83 0	0 6
12 44	4 4	14 44	3 30	19 20	2 36	28 40	1 38	47 20	0 47	84 0	0 5
12 46	4 3	14 46	3 29	19 25	2 36	28 50	1 38	47 40	0 47	85 0	0 4
12 48	4 3	14 48	3 29	19 30	2 35	29 0	1 37	48 0	0 46	86 0	0 4
12 50	4 2	14 50	3 28	19 35	2 34	29 10	1 36	48 20	0 46	87 0	0 3
12 52	4 1	14 52	3 28	19 40	2 33	29 20	1 36	48 40	0 45	88 0	0 2
12 54	4 1	14 54	3 27	19 45	2 33	29 30	1 35	49 0	0 45	89 0	0 1
12 56	4 0	14 56	3 27	19 50	2 32	29 40	1 34	49 20	0 44	90 0	0 0
12 58	3 59	14 58	3 26	19 55	2 31	29 50	1 33	49 40	0 44		

(Ther. 50.)

(Bar. 30.)

Correction of a STARS App. Alt. (*subtr.*)

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(n)

(or Refraction in Alt.)

AA	Corr.	Diff.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.
—	—	for 10'	—	—	—	—	—	—	—	—	—	—
0 0	33 51	117	5 0	9 58	6 0	8 32	7 0	7 27	8 0	6 35	9 0	5 54
0 5	32 53	113	5 1	9 56	6 1	8 31	7 1	7 26	8 1	6 34	9 2	5 53
0 10	31 58	109	5 2	9 55	6 2	8 30	7 2	7 25	8 2	6 34	9 4	5 51
0 15	31 5	105	5 3	9 53	6 3	8 28	7 3	7 24	8 3	6 33	9 6	5 50
0 20	30 13	101	5 4	9 52	6 4	8 27	7 4	7 23	8 4	6 32	9 8	5 48
0 25	29 24	97	5 5	9 50	6 5	8 26	7 5	7 22	8 5	6 31	9 10	5 47
0 30	28 37	94	5 6	9 48	6 6	8 25	7 6	7 21	8 6	6 31	9 12	5 46
0 35	27 51	90	5 7	9 47	6 7	8 24	7 7	7 20	8 7	6 30	9 14	5 45
0 40	27 6	87	5 8	9 45	6 8	8 22	7 8	7 19	8 8	6 29	9 16	5 43
0 45	26 24	84	5 9	9 44	6 9	8 21	7 9	7 18	8 9	6 29	9 18	5 42
0 50	25 43	80	5 10	9 42	6 10	8 20	7 10	7 17	8 10	6 28	9 20	5 41
0 55	25 3	77	5 11	9 40	6 11	8 19	7 11	7 16	8 11	6 27	9 22	5 40
1 0	24 25	74	5 12	9 39	6 12	8 18	7 12	7 15	8 12	6 27	9 24	5 39
1 5	23 48	71	5 13	9 37	6 13	8 17	7 13	7 14	8 13	6 26	9 26	5 38
1 10	23 13	69	5 14	9 36	6 14	8 16	7 14	7 13	8 14	6 25	9 28	5 37
1 15	22 40	66	5 15	9 34	6 15	8 14	7 15	7 12	8 15	6 24	9 30	5 36
1 20	22 8	63	5 16	9 33	6 16	8 13	7 16	7 12	8 16	6 24	9 32	5 35
1 25	21 37	61	5 17	9 31	6 17	8 12	7 17	7 11	8 17	6 23	9 34	5 34
1 30	21 7	59	5 18	9 30	6 18	8 11	7 18	7 10	8 18	6 22	9 36	5 32
1 35	20 38	57	5 19	9 28	6 19	8 10	7 19	7 9	8 19	6 22	9 38	5 31
1 40	20 10	55	5 20	9 27	6 20	8 9	7 20	7 8	8 20	6 21	9 40	5 30
1 45	19 43	53	5 21	9 25	6 21	8 8	7 21	7 7	8 21	6 20	9 42	5 29
1 50	19 17	51	5 22	9 24	6 22	8 7	7 22	7 6	8 22	6 20	9 44	5 28
1 55	18 52	49	5 23	9 22	6 23	8 6	7 23	7 5	8 23	6 19	9 46	5 27
2 0	18 29	48	5 24	9 21	6 24	8 5	7 24	7 4	8 24	6 18	9 48	5 26
2 5	18 5	46	5 25	9 19	6 25	8 3	7 25	7 3	8 25	6 17	9 50	5 25
2 10	17 43	44	5 26	9 17	6 26	8 2	7 26	7 3	8 26	6 17	9 52	5 24
2 15	17 21	43	5 27	9 16	6 27	8 1	7 27	7 2	8 27	6 16	9 54	5 23
2 20	17 0	41	5 28	9 14	6 28	8 0	7 28	7 1	8 28	6 15	9 56	5 22
2 25	16 40	40	5 29	9 13	6 29	7 59	7 29	7 0	8 29	6 15	9 58	5 21
2 30	16 21	39	5 30	9 11	6 30	7 58	7 30	6 59	8 30	6 14	10 0	5 20
2 35	16 2	37	5 31	9 10	6 31	7 57	7 31	6 58	8 31	6 13	10 2	5 19
2 40	15 43	36	5 32	9 8	6 32	7 56	7 32	6 57	8 32	6 13	10 4	5 18
2 45	15 25	35	5 33	9 7	6 33	7 55	7 33	6 57	8 33	6 12	10 6	5 17
2 50	15 8	34	5 34	9 6	6 34	7 54	7 34	6 56	8 34	6 11	10 8	5 16
2 55	14 51	33	5 35	9 4	6 35	7 52	7 35	6 55	8 35	6 10	10 10	5 15
3 0	14 35	32	5 36	9 3	6 36	7 51	7 36	6 54	8 36	6 10	10 12	5 14
3 5	14 19	31	5 37	9 2	6 37	7 50	7 37	6 53	8 37	6 9	10 14	5 13
3 10	14 4	30	5 38	9 1	6 38	7 49	7 38	6 53	8 38	6 8	10 16	5 12
3 15	13 50	29	5 39	8 59	6 39	7 48	7 39	6 52	8 39	6 8	10 18	5 11
3 20	13 35	28	5 40	8 58	6 40	7 47	7 40	6 51	8 40	6 7	10 20	5 10
3 25	13 21	27	5 41	8 57	6 41	7 46	7 41	6 50	8 41	6 6	10 22	5 9
3 30	13 7	27	5 42	8 55	6 42	7 45	7 42	6 49	8 42	6 6	10 24	5 8
3 35	12 53	26	5 43	8 54	6 43	7 44	7 43	6 49	8 43	6 5	10 26	5 7
3 40	12 41	25	5 44	8 53	6 44	7 43	7 44	6 48	8 44	6 4	10 28	5 6
3 45	12 28	24	5 45	8 51	6 45	7 42	7 45	6 47	8 45	6 3	10 30	5 5
3 50	12 16	24	5 46	8 50	6 46	7 41	7 46	6 46	8 46	6 3	10 32	5 4
3 55	12 3	23	5 47	8 49	6 47	7 40	7 47	6 45	8 47	6 2	10 34	5 3
4 0	11 52	22	5 48	8 48	6 48	7 39	7 48	6 45	8 48	6 1	10 36	5 2
4 5	11 41	21	5 49	8 46	6 49	7 38	7 49	6 44	8 49	6 1	10 38	5 1
4 10	11 30	20	5 50	8 45	6 50	7 37	7 50	6 43	8 50	6 0	10 40	5 0
4 15	11 20	20	5 51	8 44	6 51	7 36	7 51	6 42	8 51	5 59	10 42	4 59
4 20	11 10	20	5 52	8 42	6 52	7 35	7 52	6 41	8 52	5 59	10 44	4 58
4 25	11 0	19	5 53	8 41	6 53	7 34	7 53	6 41	8 53	5 58	10 46	4 58
4 30	10 50	18	5 54	8 40	6 54	7 33	7 54	6 40	8 54	5 58	10 48	4 57
4 35	10 41	18	5 55	8 38	6 55	7 32	7 55	6 39	8 55	5 57	10 50	4 56
4 40	10 32	17	5 56	8 37	6 56	7 31	7 56	6 38	8 56	5 56	10 52	4 55
4 45	10 23	17	5 57	8 36	6 57	7 30	7 57	6 37	8 57	5 56	10 54	4 54
4 50	10 15	17	5 58	8 35	6 58	7 29	7 58	6 37	8 58	5 55	10 56	4 53
4 55	10 7	16	5 59	8 33	6 59	7 28	7 59	6 36	8 59	5 55	10 58	4 52

(Ther. 50.)

(Bar. 30.)

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Correction of a STAR's App. Alt. (*subtr.*)

(or Refraction in Alt.)

(n)

AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.	AA	Corr.
11 0	4 51	13 0	4 7	15 0	3 34	20 0	2 39	30 0	1 40	50 0	0 49
11 2	4 50	13 2	4 7	15 5	3 33	20 10	2 37	30 20	1 39	50 30	0 48
11 4	4 49	13 4	4 6	15 10	3 32	20 20	2 36	30 40	1 38	51 0	0 47
11 6	4 49	13 6	4 6	15 15	3 31	20 30	2 35	31 0	1 37	51 30	0 46
11 8	4 48	13 8	4 5	15 20	3 30	20 40	2 33	31 20	1 35	52 0	0 45
11 10	4 47	13 10	4 4	15 25	3 28	20 50	2 32	31 40	1 34	52 30	0 45
11 12	4 46	13 12	4 4	15 30	3 27	21 0	2 30	32 0	1 33	53 0	0 44
11 14	4 45	13 14	4 3	15 35	3 26	21 10	2 29	32 20	1 32	53 30	0 43
11 16	4 45	13 16	4 3	15 40	3 25	21 20	2 28	32 40	1 31	54 0	0 42
11 18	4 44	13 18	4 2	15 45	3 24	21 30	2 27	33 0	1 29	54 30	0 41
11 20	4 43	13 20	4 1	15 50	3 23	21 40	2 26	33 20	1 28	55 0	0 41
11 22	4 42	13 22	4 1	15 55	3 22	21 50	2 24	33 40	1 27	55 30	0 40
11 24	4 41	13 24	4 0	16 0	3 21	22 0	2 23	34 0	1 26	56 0	0 39
11 26	4 41	13 26	4 0	16 5	3 20	22 10	2 22	34 20	1 25	56 30	0 38
11 28	4 40	13 28	3 59	16 10	3 18	22 20	2 21	34 40	1 24	57 0	0 38
11 30	4 39	13 30	3 58	16 15	3 17	22 30	2 20	35 0	1 23	57 30	0 37
11 32	4 38	13 32	3 58	16 20	3 16	22 40	2 19	35 20	1 22	58 0	0 36
11 34	4 37	13 34	3 57	16 25	3 15	22 50	2 18	35 40	1 21	58 30	0 36
11 36	4 37	13 36	3 57	16 30	3 14	23 0	2 16	36 0	1 20	59 0	0 35
11 38	4 36	13 38	3 56	16 35	3 13	23 10	2 15	36 20	1 19	59 30	0 34
11 40	4 35	13 40	3 55	16 40	3 12	23 20	2 14	36 40	1 18	60 0	0 34
11 42	4 34	13 42	3 55	16 45	3 11	23 30	2 13	37 0	1 17	60 30	0 33
11 44	4 33	13 44	3 54	16 50	3 10	23 40	2 12	37 20	1 16	61 0	0 32
11 46	4 33	13 46	3 54	16 55	3 9	23 50	2 11	37 40	1 15	61 30	0 32
11 48	4 32	13 48	3 53	17 0	3 8	24 0	2 10	38 0	1 14	62 0	0 31
11 50	4 31	13 50	3 53	17 5	3 7	24 10	2 9	38 20	1 13	62 30	0 30
11 52	4 30	13 52	3 52	17 10	3 7	24 20	2 8	38 40	1 13	63 0	0 30
11 54	4 30	13 54	3 51	17 15	3 6	24 30	2 7	39 0	1 12	63 30	0 29
11 56	4 29	13 56	3 51	17 20	3 5	24 40	2 6	39 20	1 11	64 0	0 28
11 58	4 29	13 58	3 50	17 25	3 4	24 50	2 5	39 40	1 10	64 30	0 28
12 0	4 28	14 0	3 50	17 30	3 3	25 0	2 4	40 0	1 9	65 0	0 27
12 2	4 27	14 2	3 49	17 35	3 2	25 10	2 3	40 20	1 8	65 30	0 26
12 4	4 27	14 4	3 49	17 40	3 1	25 20	2 2	40 40	1 8	66 0	0 26
12 6	4 26	14 6	3 48	17 45	3 0	25 30	2 1	41 0	1 7	66 30	0 25
12 8	4 25	14 8	3 48	17 50	2 59	25 40	2 1	41 20	1 6	67 0	0 25
12 10	4 24	14 10	3 47	17 55	2 58	25 50	2 0	41 40	1 5	67 30	0 24
12 12	4 24	14 12	3 47	18 0	2 58	26 0	1 59	42 0	1 5	68 0	0 23
12 14	4 23	14 14	3 46	18 5	2 57	26 10	1 58	42 20	1 4	69 0	0 22
12 16	4 22	14 16	3 45	18 10	2 56	26 20	1 57	42 40	1 3	70 0	0 21
12 18	4 21	14 18	3 45	18 15	2 55	26 30	1 56	43 0	1 2	71 0	0 20
12 20	4 21	14 20	3 44	18 20	2 54	26 40	1 55	43 20	1 2	72 0	0 19
12 22	4 20	14 22	3 44	18 25	2 53	26 50	1 55	43 40	1 1	73 0	0 18
12 24	4 19	14 24	3 43	18 30	2 53	27 0	1 54	44 0	1 0	74 0	0 17
12 26	4 19	14 26	3 43	18 35	2 52	27 10	1 53	44 20	1 0	75 0	0 16
12 28	4 18	14 28	3 42	18 40	2 51	27 20	1 52	44 40	0 59	76 0	0 14
12 30	4 17	14 30	3 42	18 45	2 50	27 30	1 51	45 0	0 58	77 0	0 13
12 32	4 17	14 32	3 41	18 50	2 49	27 40	1 51	45 20	0 57	78 0	0 12
12 34	4 16	14 34	3 41	18 55	2 48	27 50	1 50	45 40	0 57	79 0	0 11
12 36	4 15	14 36	3 40	19 0	2 48	28 0	1 49	46 0	0 56	80 0	0 10
12 38	4 15	14 38	3 40	19 5	2 47	28 10	1 48	46 20	0 55	81 0	0 9
12 40	4 14	14 40	3 39	19 10	2 46	28 20	1 48	46 40	0 55	82 0	0 8
12 42	4 13	14 42	3 39	19 15	2 45	28 30	1 47	47 0	0 54	83 0	0 7
12 44	4 13	14 44	3 38	19 20	2 45	28 40	1 46	47 20	0 53	84 0	0 6
12 46	4 12	14 46	3 38	19 25	2 44	28 50	1 45	47 40	0 53	85 0	0 5
12 48	4 11	14 48	3 37	19 30	2 43	29 0	1 45	48 0	0 52	86 0	0 4
12 50	4 11	14 50	3 37	19 35	2 42	29 10	1 44	48 20	0 52	87 0	0 3
12 52	4 10	14 52	3 36	19 40	2 42	29 20	1 43	48 40	0 51	88 0	0 2
12 54	4 9	14 54	3 36	19 45	2 41	29 30	1 43	49 0	0 50	89 0	0 1
12 56	4 9	14 56	3 35	19 50	2 40	29 40	1 42	49 20	0 50	90 0	0 0
12 58	4 8	14 58	3 35	19 55	2 39	29 50	1 41	49 40	0 49		

Correction for POLE STAR.

(o)

	LAT. 30°			LAT. 50°			LAT. 70°					
Mer. R. A.	1830			1840			1830			1840		
h. m.	°	'	"	°	'	"	°	'	"	°	'	"
0 0	-1	32	35	-1	28	56	-1	32	32	-1	28	45
0 10	-1	33	35	-1	29	57	-1	33	33	-1	29	46
0 20	-1	34	24	-1	30	48	-1	34	23	-1	30	40
0 30	-1	35	3	-1	31	27	-1	35	2	-1	31	24
0 40	-1	35	30	-1	31	56	-1	35	30	-1	31	55
0 50	-1	35	46	-1	32	15	-1	35	47	-1	32	15
1 0	-1	35	51	-1	32	22	-1	35	52	-1	32	23
1 10	-1	35	45	-1	32	19	-1	35	45	-1	32	21
1 20	-1	35	28	-1	32	5	-1	35	27	-1	32	5
1 30	-1	35	0	-1	31	40	-1	34	59	-1	31	39
1 40	-1	34	21	-1	31	5	-1	34	19	-1	31	3
1 50	-1	33	30	-1	30	20	-1	33	27	-1	30	14
2 0	-1	32	20	-1	29	24	-1	32	25	-1	29	14
2 10	-1	31	17	-1	28	17	-1	31	12	-1	28	2
2 20	-1	29	55	-1	27	0	-1	29	49	-1	26	41
2 30	-1	28	22	-1	25	33	-1	28	14	-1	25	10
2 40	-1	26	39	-1	23	56	-1	26	30	-1	23	28
2 50	-1	24	46	-1	22	9	-1	24	35	-1	21	34
3 0	-1	22	43	-1	20	13	-1	22	30	-1	19	32
3 10	-1	20	30	-1	18	8	-1	20	16	-1	17	20
3 20	-1	18	8	-1	15	54	-1	17	52	-1	15	0
3 30	-1	15	38	-1	13	31	-1	15	18	-1	13	29
3 40	-1	12	59	-1	11	0	-1	12	36	-1	10	50
3 50	-1	10	11	-1	8	20	-1	9	47	-1	8	2
4 0	-1	7	15	-1	5	33	-1	6	49	-1	5	8
4 10	-1	4	11	-1	2	38	-1	3	43	-1	2	5
4 20	-1	1	0	-0	59	35	-1	0	30	-0	59	56
4 30	-0	57	42	-0	56	26	-0	57	10	-0	55	41
4 40	-0	54	17	-0	53	11	-0	53	45	-0	52	19
4 50	-0	50	46	-0	49	50	-0	50	11	-0	49	51
5 0	-0	47	10	-0	46	23	-0	46	32	-0	45	48
5 10	-0	43	28	-0	42	50	-0	42	49	-0	42	14
5 20	-0	39	41	-0	39	12	-0	39	0	-0	38	35
5 30	-0	35	49	-0	35	30	-0	35	7	-0	34	51
5 40	-0	31	54	-0	31	44	-0	31	10	-0	31	4
5 50	-0	27	56	-0	27	55	-0	27	10	-0	27	13
6 0	-0	23	54	-0	24	2	-0	23	7	-0	23	20
6 10	-0	19	49	-0	20	6	-0	19	1	-0	19	24
6 20	-0	15	42	-0	16	9	-0	14	54	-0	15	26
6 30	-0	11	33	-0	12	11	-0	10	45	-0	11	26
6 40	-0	7	23	-0	8	11	-0	6	34	-0	7	25
6 50	-0	3	12	-0	4	9	-0	2	23	-0	3	23
7 0	+0	0	58	-0	0	7	+0	1	48	+0	0	36
7 10	+0	5	8	+0	3	54	+0	5	58	+0	4	40
7 20	+0	9	19	+0	7	56	+0	10	7	+0	8	41
7 30	+0	13	28	+0	11	54	+0	14	14	+0	12	40
7 40	+0	17	35	+0	15	52	+0	18	21	+0	16	38
7 50	+0	21	41	+0	19	50	+0	22	26	+0	20	35

Correction for POLE STAR.

(o)

Mer. R. A.	LAT. 30°			LAT. 50°			LAT. 70°		
	1830	1840		1830	1840		1830	1840	
h. m.	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "
8 0	+0 25 43	+0 23 46	+0 26 28	+0 24 28	+0 28 21	+0 26 13	+0 28 21	+0 26 13	+0 26 13
8 10	+0 29 42	+0 27 38	+0 30 27	+0 28 19	+0 32 16	+0 30 0	+0 32 16	+0 30 0	+0 30 0
8 20	+0 33 39	+0 31 26	+0 34 21	+0 32 6	+0 36 7	+0 33 45	+0 36 7	+0 33 45	+0 33 45
8 30	+0 37 31	+0 35 11	+0 38 12	+0 35 50	+0 39 55	+0 37 25	+0 39 55	+0 37 25	+0 37 25
8 40	+0 41 19	+0 38 52	+0 41 59	+0 39 29	+0 43 37	+0 41 0	+0 43 37	+0 41 0	+0 41 0
8 50	+0 45 2	+0 42 28	+0 45 40	+0 43 4	+0 47 13	+0 44 32	+0 47 13	+0 44 32	+0 44 32
9 0	+0 48 40	+0 46 0	+0 49 16	+0 46 33	+0 50 46	+0 47 58	+0 50 46	+0 47 58	+0 47 58
9 10	+0 52 12	+0 49 27	+0 52 47	+0 49 58	+0 54 10	+0 51 18	+0 54 10	+0 51 18	+0 51 18
9 20	+0 55 39	+0 52 47	+0 56 11	+0 53 16	+0 57 31	+0 54 32	+0 57 31	+0 54 32	+0 54 32
9 30	+0 59 0	+0 56 0	+0 59 29	+0 56 29	+1 0 44	+0 57 40	+1 0 44	+0 57 40	+0 57 40
9 40	+1 2 13	+0 59 9	+1 2 41	+0 59 36	+1 3 48	+1 0 41	+1 3 48	+1 0 41	+1 0 41
9 50	+1 5 19	+1 2 10	+1 5 45	+1 2 35	+1 6 48	+1 3 34	+1 6 48	+1 3 34	+1 3 34
10 0	+1 8 18	+1 5 5	+1 8 42	+1 5 27	+1 9 39	+1 6 20	+1 9 39	+1 6 20	+1 6 20
10 10	+1 11 9	+1 7 52	+1 11 30	+1 8 12	+1 12 23	+1 9 1	+1 12 23	+1 9 1	+1 9 1
10 20	+1 13 53	+1 10 31	+1 14 11	+1 10 49	+1 15 0	+1 11 34	+1 15 0	+1 11 34	+1 11 34
10 30	+1 16 27	+1 13 2	+1 16 44	+1 13 18	+1 17 27	+1 13 59	+1 17 27	+1 13 59	+1 13 59
10 40	+1 18 53	+1 15 25	+1 19 8	+1 15 39	+1 19 46	+1 16 15	+1 19 46	+1 16 15	+1 16 15
10 50	+1 21 10	+1 17 39	+1 21 23	+1 17 52	+1 21 57	+1 18 23	+1 21 57	+1 18 23	+1 18 23
11 0	+1 23 18	+1 19 45	+1 23 29	+1 19 56	+1 24 0	+1 20 23	+1 24 0	+1 20 23	+1 20 23
11 10	+1 25 17	+1 21 42	+1 25 27	+1 21 51	+1 25 51	+1 22 15	+1 25 51	+1 22 15	+1 22 15
11 20	+1 27 6	+1 23 29	+1 27 14	+1 23 37	+1 27 34	+1 23 58	+1 27 34	+1 23 58	+1 23 58
11 30	+1 28 45	+1 25 7	+1 28 52	+1 25 14	+1 29 8	+1 25 30	+1 29 8	+1 25 30	+1 25 30
11 40	+1 30 14	+1 26 36	+1 30 19	+1 26 41	+1 30 34	+1 26 53	+1 30 34	+1 26 53	+1 26 53
11 50	+1 31 33	+1 27 55	+1 31 37	+1 27 58	+1 31 49	+1 28 8	+1 31 49	+1 28 8	+1 28 8
12 0	+1 32 42	+1 29 4	+1 32 44	+1 29 6	+1 32 53	+1 29 13	+1 32 53	+1 29 13	+1 29 13
12 10	+1 33 40	+1 30 2	+1 33 42	+1 30 4	+1 33 49	+1 30 10	+1 33 49	+1 30 10	+1 30 10
12 20	+1 34 28	+1 30 50	+1 34 29	+1 30 52	+1 34 34	+1 30 58	+1 34 34	+1 30 58	+1 30 58
12 30	+1 35 5	+1 31 29	+1 35 5	+1 31 30	+1 35 8	+1 31 34	+1 35 8	+1 31 34	+1 31 34
12 40	+1 35 31	+1 31 57	+1 35 31	+1 31 57	+1 35 34	+1 31 59	+1 35 34	+1 31 59	+1 31 59
12 50	+1 35 46	+1 32 14	+1 35 47	+1 32 14	+1 35 48	+1 32 14	+1 35 48	+1 32 14	+1 32 14
13 0	+1 35 51	+1 32 22	+1 35 52	+1 32 22	+1 35 54	+1 32 22	+1 35 54	+1 32 22	+1 32 22
13 10	+1 35 46	+1 32 20	+1 35 45	+1 32 21	+1 35 47	+1 32 21	+1 35 47	+1 32 21	+1 32 21
13 20	+1 35 29	+1 32 6	+1 35 29	+1 32 7	+1 35 31	+1 32 6	+1 35 31	+1 32 6	+1 32 6
13 30	+1 35 1	+1 31 41	+1 35 2	+1 31 42	+1 35 4	+1 31 44	+1 35 4	+1 31 44	+1 31 44
13 40	+1 34 24	+1 31 7	+1 34 25	+1 31 8	+1 34 29	+1 31 11	+1 34 29	+1 31 11	+1 31 11
13 50	+1 33 35	+1 30 23	+1 33 26	+1 30 25	+1 33 43	+1 30 30	+1 33 43	+1 30 30	+1 30 30
14 0	+1 32 36	+1 29 29	+1 32 38	+1 29 31	+1 32 47	+1 29 38	+1 32 47	+1 29 38	+1 29 38
14 10	+1 31 26	+1 28 24	+1 31 30	+1 28 27	+1 31 41	+1 28 37	+1 31 41	+1 28 37	+1 28 37
14 20	+1 30 6	+1 27 10	+1 30 11	+1 27 14	+1 30 25	+1 27 26	+1 30 25	+1 27 26	+1 27 26
14 30	+1 28 36	+1 25 45	+1 28 42	+1 25 51	+1 29 0	+1 26 4	+1 29 0	+1 26 4	+1 26 4
14 40	+1 26 56	+1 24 11	+1 27 4	+1 24 18	+1 27 25	+1 24 37	+1 27 25	+1 24 37	+1 24 37
14 50	+1 25 6	+1 22 27	+1 25 16	+1 22 36	+1 25 42	+1 22 58	+1 25 42	+1 22 58	+1 22 58
15 0	+1 23 6	+1 20 34	+1 23 18	+1 20 45	+1 23 48	+1 21 10	+1 23 48	+1 21 10	+1 21 10
15 10	+1 20 57	+1 18 32	+1 21 10	+1 18 45	+1 21 45	+1 19 14	+1 21 45	+1 19 14	+1 19 14
15 20	+1 18 39	+1 16 22	+1 18 55	+1 16 35	+1 19 34	+1 17 9	+1 19 34	+1 17 9	+1 17 9
15 30	+1 16 13	+1 14 2	+1 16 30	+1 14 16	+1 17 13	+1 14 54	+1 17 13	+1 14 54	+1 14 54
15 40	+1 13 37	+1 11 34	+1 13 56	+1 11 49	+1 14 45	+1 12 35	+1 14 45	+1 12 35	+1 12 35
15 50	+1 10 53	+1 8 58	+1 11 15	+1 9 16	+1 12 9	+1 10 6	+1 12 9	+1 10 6	+1 10 6

(o)

Correction for POLE STAR.

Mer. R. A.	LAT. 30°						LAT. 50°						LAT. 70°					
	1830			1840			1830			1840			1830			1840		
h. m.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
16 0	+1	8	1	+1	6	14	+1	8	25	+1	6	36	+1	9	23	+1	7	29
16 10	+1	5	2	+1	3	23	+1	5	28	+1	3	46	+1	6	31	+1	4	44
16 20	+1	1	55	+1	0	25	+1	2	23	+1	0	50	1	3	31	+1	1	52
16 30	+0	58	40	+0	57	19	+0	59	10	0	57	47	+1	0	23	+0	58	54
16 40	+0	55	20	+0	54	7	+0	55	51	+0	54	37	+0	57	11	+0	55	50
16 50	+0	51	53	+0	50	50	+0	52	27	0	51	21	+0	53	51	+0	52	39
17 0	+0	48	20	+0	47	26	+0	48	56	+0	47	59	+0	50	25	+0	49	19
17 10	+0	44	42	+0	43	56	+0	45	19	+0	44	31	+0	46	53	+0	45	56
17 20	+0	40	58	+0	40	22	+0	41	38	+0	40	58	+0	43	14	+0	42	27
17 30	+0	37	9	+0	36	43	+0	37	51	+0	37	21	+0	39	32	+0	38	55
17 40	+0	33	17	+0	33	0	+0	33	59	0	33	39	+0	35	45	+0	35	16
17 50	+0	29	20	+0	29	13	+0	30	4	+0	29	52	+0	31	53	+0	31	34
18 0	+0	25	20	+0	25	22	+0	26	5	+0	26	4	+0	27	58	+0	27	48
18 10	+0	21	17	+0	21	29	+0	22	4	+0	22	11	+0	24	0	+0	23	59
18 20	+0	17	12	+0	17	32	+0	17	59	+0	18	16	+0	19	58	+0	20	5
18 30	+0	13	4	+0	13	35	+0	13	52	+0	14	18	+0	15	54	+0	16	10
18 40	+0	8	55	+0	9	35	+0	9	44	+0	10	20	+0	11	45	+0	12	13
18 50	+0	4	45	+0	5	34	0	5	34	+0	6	19	+0	7	38	+0	8	14
19 0	+0	0	35	+0	1	33	+0	1	23	+0	2	18	+0	3	39	+0	4	13
19 10	+0	3	36	+0	2	29	0	2	47	+0	1	43	+0	0	42	+0	0	12
19 20	+0	7	47	+0	6	31	+0	6	58	+0	5	45	+0	4	53	+0	3	50
19 30	+0	11	56	+0	10	31	+0	11	8	+0	9	46	+0	9	3	+0	7	51
19 40	+0	16	5	+0	14	31	+0	15	17	+0	13	46	+0	13	13	+0	11	53
19 50	+0	20	12	+0	18	29	+0	19	25	+0	17	45	+0	17	22	+0	15	53
20 0	+0	24	16	+0	22	25	+0	23	30	+0	21	43	+0	21	30	+0	19	51
20 10	+0	28	18	+0	26	21	+0	27	32	+0	25	37	+0	25	35	+0	23	48
20 20	+0	32	16	+0	30	10	+0	31	32	+0	29	29	+0	29	38	+0	27	43
20 30	+0	36	11	+0	33	57	+0	35	29	+0	33	17	+0	33	39	+0	31	34
20 40	+0	40	3	+0	37	41	+0	39	21	+0	37	2	+0	37	36	+0	35	21
20 50	+0	43	51	+0	41	20	+0	43	10	+0	40	43	+0	41	27	+0	39	5
21 0	+0	47	34	+0	44	55	+0	46	53	+0	44	19	+0	45	13	+0	42	47
21 10	+0	51	10	+0	48	24	+0	50	31	+0	47	51	+0	48	57	+0	46	22
21 20	0	54	40	+0	51	48	+0	54	3	+0	51	17	+0	52	34	+0	49	53
21 30	+0	58	1	+0	55	6	+0	57	29	+0	54	36	+0	56	6	+0	53	18
21 40	+1	1	18	+0	58	18	+1	0	49	+0	57	50	+0	59	30	+0	56	37
21 50	+1	4	29	+1	1	23	+1	4	1	+1	0	57	+1	2	48	+0	59	48
22 0	+1	7	31	+1	4	21	+1	7	6	+1	3	57	+1	6	0	+1	2	53
22 10	+1	10	27	+1	7	12	+1	10	3	+1	6	50	+1	9	1	+1	5	52
22 20	+1	13	13	+1	9	55	+1	12	53	+1	9	35	+1	11	57	+1	8	42
22 30	+1	15	52	+1	12	29	+1	15	33	+1	12	12	+1	14	44	+1	11	24
22 40	+1	18	22	+1	14	56	+1	18	5	+1	14	40	+1	17	21	+1	13	58
22 50	+1	20	43	+1	17	14	+1	20	28	+1	17	0	+1	19	49	+1	16	23
23 0	+1	22	55	+1	19	23	+1	22	42	+1	19	11	+1	22	8	+1	18	38
23 10	+1	24	57	+1	21	25	+1	24	46	+1	21	13	+1	24	18	+1	20	45
23 20	+1	26	49	+1	23	13	+1	26	40	+1	23	4	+1	26	16	+1	22	41
23 30	+1	28	31	+1	24	54	+1	28	24	+1	24	47	+1	28	3	+1	24	27
23 40	+1	30	3	+1	26	22	+1	29	57	+1	26	19	+1	29	41	+1	26	4
23 50	+1	31	24	+1	27	47	+1	31	20	+1	27	42	+1	31	8	+1	27	30

(o)1.

Increase of R. A. of
Mean Sun, or of Sid.
Time at Mean Noon,
for Hours, Minutes,
and Seconds of Mean
Time.

	For Hours.	For Minutes.	For Seconds.
m	Sec.	Sec.	
1 0 9.8565	0.164	0.003	
2 0 19.713	0.329	0.006	
3 0 29.569	0.493	0.008	
4 0 39.426	0.658	0.011	
5 0 49.282	0.822	0.014	
6 0 59.139	0.986	0.017	
7 1 8.995	1.150	0.019	
8 1 18.852	1.315	0.022	
9 1 28.708	1.479	0.025	
10 1 38.565	1.643	0.027	
11 1 48.421	1.807	0.030	
12 1 58.278	1.972	0.033	
13 2 8.134	2.136	0.036	
14 2 17.991	2.300	0.038	
15 2 27.847	2.464	0.041	
16 2 37.704	2.629	0.044	
17 2 47.560	2.793	0.047	
18 2 57.417	2.957	0.050	
19 3 7.273	3.121	0.053	
20 3 17.130	3.286	0.055	
21 3 26.987	3.450	0.058	
22 3 36.844	3.614	0.061	
23 3 46.700	3.779	0.064	
24 3 56.556	3.943	0.066	
25 4.108	0.069		
26 4.272	0.072		
27 4.436	0.075		
28 4.600	0.077		
29 4.764	0.080		
30 4.928	0.082		
31 5.092	0.085		
32 5.257	0.088		
33 5.421	0.091		
34 5.585	0.094		
35 5.750	0.097		
36 5.914	0.100		
37 6.078	0.103		
38 6.242	0.106		
39 6.407	0.108		
40 6.571	0.111		
41 6.735	0.114		
42 6.900	0.116		
43 7.064	0.119		
44 7.228	0.122		
45 7.393	0.125		
46 7.557	0.128		
47 7.722	0.131		
48 7.886	0.133		
49 8.050	0.136		
50 8.214	0.138		
51 8.378	0.141		
52 8.543	0.144		
53 8.707	0.147		
54 8.872	0.150		
55 9.036	0.152		
56 9.200	0.155		
57 9.364	0.157		
58 9.528	0.159		
59 9.692	0.162		

(o)2

Distance of objects first seen at sea when eye on sea: if eye at known
distance above sea, add distance for that height.

Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.	Height, Ft.	Distance, Naut. Miles.
1	1.15	22	5.40	43	7.54	120	12.60	300	19.91	520	26.22	940	35.25	2800	60.8
2	1.63	23	5.51	44	7.62	125	12.85	310	20.24	540	26.71	960	35.62	2900	61.9
3	1.99	24	5.63	45	7.70	130	13.11	320	20.57	560	27.21	980	35.99	3000	63.0
4	2.31	25	5.75	46	7.79	135	13.36	330	20.88	580	27.69	1000	36.40	3100	64.1
5	2.58	26	5.87	47	7.88	140	13.60	340	21.20	600	28.17	1100	38.10	3200	65.0
6	2.82	27	5.98	48	7.97	145	13.84	350	21.51	620	28.62	1200	39.90	3300	66.0
7	3.04	28	6.08	49	8.05	150	14.08	360	21.81	640	29.09	1300	41.40	3400	67.0
8	3.25	29	6.19	50	8.12	160	14.54	370	22.12	660	29.54	1400	43.00	3500	68.0
9	3.45	30	6.30	55	8.52	170	14.99	380	22.41	680	29.98	1500	44.50	3600	69.0
10	3.64	31	6.41	60	8.91	180	15.43	390	22.71	700	30.42	1600	46.00	3700	69.9
11	3.81	32	6.50	65	9.27	190	15.85	400	22.99	720	30.85	1700	47.40	3800	70.9
12	3.99	33	6.60	70	9.62	200	16.26	410	23.28	740	31.28	1800	48.80	3900	71.8
13	4.14	34	6.70	75	9.96	210	16.66	420	23.56	760	31.70	1900	50.20	4000	72.7
14	4.35	35	6.80	80	10.28	220	17.05	430	23.84	780	32.11	2000	51.50	4100	73.6
15	4.46	36	6.90	85	10.60	230	17.43	440	24.12	800	32.52	2100	52.70	4200	74.5
16	4.60	37	6.99	90	10.90	240	17.81	450	24.39	820	32.92	2200	54.00	4300	75.4
17	4.74	38	7.09	95	11.20	250	18.16	460	24.65	840	33.32	2300	55.10	4400	76.2
18	4.88	39	7.18	100	11.50	260	18.54	470	24.93	860	33.72	2400	56.30	4500	77.0
19	5.02	40	7.27	105	11.79	270	18.90	480	25.18	880	34.11	2500	57.50	4600	77.9
20	5.15	41	7.36	110	12.06	280	19.24	490	25.45	900	34.49	2600	58.70	4700	78.8
21	5.27	42	7.45	115	12.34	290	19.58	500	25.70	920	34.88	2700	59.80	4800	79.5

(o)3

Equation of 2nd Differences.
(Multiply Tab. Nr. by Second
Difference.)

For Period 1h.	Tab. Number.	For Period 3h.
m	m	m
0	60	0.00000
1	59	0.00819
2	58	0.01611
3	57	0.02375
4	56	0.03111
5	55	0.03819
6	54	0.04500
7	53	0.05153
8	52	0.05778
9	51	0.06375
10	50	0.06944
11	49	0.07486
12	48	0.08000
13	47	0.08486
14	46	0.08944
15	45	0.09375
16	44	0.09778
17	43	0.10153
18	42	0.10500
19	41	0.10819
20	40	0.11111
21	39	0.11375
22	38	0.11611
23	37	0.11819
24	36	0.12000
25	35	0.12153
26	34	0.12278
27	33	0.12375
28	32	0.12444
29	31	0.12486
30	30	0.12500

(o)4

Logarithms for clearing Distance.

Alt.	For Sun.	For Star.	Alt.	For Sun.	For Star.
3	.000092	.000093	37	.000108	.000120
4	.000101	.000102	38	.000108	.000120
5	.000106	.000107	39	.000108	.000120
6	.000109	.000111	40	.000108	.000120
7	.000111	.000113	41	.000107	.000120
8	.000112	.000114	42	.000107	.000120
9	.000113	.000115	43	.000107	.000120
10	.000113	.000116	44	.000107	.000120
11	.000113	.000117	45	.000107	.000120
12	.000113	.000117	46	.000107	.000120
13	.000113	.000118	47	.000106	.000120
14	.000113	.000118	48	.000106	.000120
15	.000113	.000119	49	.000106	.000120
16	.000113	.000119	50	.000105	.000120
17	.000113	.000119	51	.000105	.000120
18	.000113	.000119	52	.000105	.000120
19	.000113	.000119	53	.000105	.000120
20	.000113	.000119	54	.000105	.000120
21	.000112	.000119	55	.000104	.000120
22	.000112	.000119	56	.000104	.000120
23	.000112	.000119	57	.000104	.000120
24	.000112	.000119	58	.000104	.000120
25	.000112	.000119	59	.000104	.000120
26	.000111	.000119	60	.000104	.000120
27	.000111	.000120	61	.000104	.000120
28	.000111	.000120	62	.000104	.000120
29	.000111	.000120	63	.000103	.000120
30	.000110	.000120	64	.000103	.000120
31	.000110	.000120	65	.000103	.000120
32	.000110	.000120	66	.000103	.000120
33	.000109	.000120	67	.000103	.000120
34	.000109	.000120	68	.000103	.000120
35	.000109	.000120	69	.000102	.000120
36	.000109	.000120	90	.000102	.000120

(o)5

LOGISTIC LOGARITHMS.

Sec.	0m	1m	2m	3m	4m	5m	6m	7m	8m	9m
0		1.77815	1.47712	1.30103	1.17609	1.07918	1.00000	.93305	.87506	.82391
2	3.25527	1.76391	1.46994	1.29625	1.17249	1.07630	.99760	.93099	.87326	.82236
4	2.95424	1.75012	1.46288	1.29149	1.16891	1.07343	.99520	.92894	.87146	.82070
6	2.77815	1.73676	1.45593	1.28679	1.16537	1.07058	.99282	.92689	.86967	.81911
8	2.65321	1.72379	1.44909	1.28215	1.16185	1.06775	.99046	.92486	.86788	.81752
10	2.55630	1.71121	1.44236	1.27755	1.15836	1.06494	.98810	.92284	.86611	.81594
12	2.47712	1.69897	1.43573	1.27300	1.15490	1.06215	.98576	.92082	.86433	.81436
14	2.41018	1.68707	1.42920	1.26850	1.15147	1.05937	.98343	.91881	.86258	.81279
16	2.35218	1.67549	1.42276	1.26405	1.14806	1.05662	.98112	.91682	.86082	.81123
18	2.30103	1.66421	1.41642	1.25964	1.14468	1.05388	.97881	.91483	.85907	.80967
20	2.25527	1.65321	1.41018	1.25527	1.14133	1.05115	.97652	.91285	.85733	.80812
22	2.21388	1.64249	1.40402	1.25095	1.13800	1.04845	.97424	.91088	.85560	.80657
24	2.17609	1.63202	1.39794	1.24667	1.13470	1.04576	.97197	.90892	.85387	.80503
26	2.14133	1.62181	1.39195	1.24244	1.13142	1.04309	.96972	.90697	.85215	.80349
28	2.10915	1.61182	1.38604	1.23824	1.12817	1.04043	.96747	.90503	.85044	.80196
30	2.07918	1.60206	1.38021	1.23408	1.12494	1.03779	.96524	.90309	.84873	.80043
32	2.05115	1.59252	1.37446	1.22997	1.12173	1.03517	.96302	.90117	.84703	.79891
34	2.02482	1.58318	1.36878	1.22590	1.11855	1.03256	.96081	.89925	.84534	.79740
36	2.00000	1.57403	1.36318	1.22195	1.11540	1.02996	.95861	.89734	.84365	.79588
38	1.97652	1.56508	1.35765	1.21785	1.11226	1.02739	.95642	.89544	.84197	.79438
40	1.95424	1.55630	1.35218	1.21388	1.10915	1.02482	.95424	.89355	.84030	.79288
42	1.93305	1.54770	1.34679	1.20995	1.10605	1.02228	.95208	.89166	.83863	.79138
44	1.91285	1.53927	1.34146	1.20606	1.10300	1.01975	.94992	.88980	.83697	.78990
46	1.89355	1.53100	1.33620	1.20220	1.09994	1.01723	.94778	.88792	.83532	.78841
48	1.87506	1.52288	1.33100	1.19837	1.09691	1.01472	.94564	.88606	.83367	.78693
50	1.85733	1.51491	1.32585	1.19458	1.09391	1.01224	.94352	.88421	.83203	.78545
52	1.84030	1.50709	1.32078	1.19082	1.09092	1.00976	.94141	.88236	.83040	.78398
54	1.82391	1.49940	1.31575	1.18710	1.08796	1.00730	.93930	.88053	.82876	.78252
56	1.80812	1.49185	1.31079	1.18340	1.08501	1.00485	.93721	.87870	.82714	.78106
58	1.79288	1.48442	1.30588	1.17973	1.08210	1.00242	.93513	.87688	.82552	.77960
60	1.77815	1.47712	1.30103	1.17610	1.07918	1.00000	.93305	.87506	.82391	.77815

Sec.	10m	11m	12m	13m	14m	15m	16m	17m	18m	19m
0	.77815	.73676	.69897	.66421	.63202	.60206	.57403	.54770	.52288	.49940
2	.77671	.73545	.69777	.66310	.63099	.60110	.57313	.54685	.52208	.49864
4	.77527	.73414	.69657	.66199	.62996	.60014	.57223	.54600	.52127	.49788
6	.77383	.73283	.69537	.66088	.62893	.59918	.57133	.54516	.52047	.49712
8	.77240	.73153	.69417	.65978	.62791	.59822	.57043	.54431	.51967	.49636
10	.77097	.73023	.69298	.65868	.62688	.59726	.56953	.54347	.51888	.49561
12	.76955	.72893	.69179	.65758	.62586	.59631	.56864	.54262	.51808	.49485
14	.76814	.72764	.69061	.65648	.62485	.59536	.56774	.54178	.51729	.49410
16	.76672	.72636	.68943	.65539	.62383	.59441	.56685	.54094	.51649	.49335
18	.76532	.72507	.68825	.65430	.62282	.59346	.56596	.54011	.51570	.49260
20	.76391	.72379	.68707	.65321	.62181	.59252	.56508	.53927	.51491	.49185
22	.76251	.72252	.68590	.65213	.62080	.59157	.56419	.53844	.51412	.49110
24	.76112	.72125	.68473	.65105	.61979	.59063	.56331	.53760	.51333	.49035
26	.75973	.71998	.68356	.64997	.61879	.58969	.56243	.53677	.51255	.48961
28	.75834	.71872	.68240	.64889	.61778	.58876	.56155	.53594	.51176	.48886
30	.75696	.71745	.68124	.64782	.61678	.58782	.56067	.53511	.51098	.48812
32	.75559	.71620	.68009	.64675	.61579	.58689	.55979	.53429	.51020	.48738
34	.75421	.71494	.67893	.64568	.61479	.58596	.55892	.53346	.50942	.48662
36	.75285	.71369	.67778	.64461	.61380	.58503	.55804	.53264	.50864	.48590
38	.75148	.71245	.67663	.64355	.61281	.58410	.55717	.53182	.50786	.48516
40	.75012	.71121	.67549	.64249	.61182	.58318	.55630	.53100	.50709	.48442
42	.74877	.70997	.67435	.64143	.61084	.58225	.55544	.53018	.50631	.48369
44	.74742	.70873	.67321	.64038	.60985	.58133	.55457	.52936	.50554	.48295
46	.74607	.70750	.67207	.63932	.60887	.58041	.55371	.52855	.50477	.48222
48	.74473	.70627	.67094	.63827	.60789	.57950	.55284	.52773	.50399	.48149
50	.74339	.70505	.66981	.63723	.60691	.57858	.55198	.52692	.50323	.48076
52	.74206	.70382	.66869	.63618	.60594	.57767	.55112	.52611	.50246	.48003
54	.74073	.70261	.66756	.63514	.60497	.57676	.55027	.52530	.50169	.47930
56	.73940	.70139	.66644	.63410	.60400	.57585	.54941	.52449	.50093	.47857
58	.73808	.70018	.66532	.63306	.60303	.57494	.54856	.52368	.50016	.47785
60	.73676	.69897	.66421	.63202	.60206	.57403	.54770	.52288	.49940	.47712

(o)5

LOGISTIC LOGARITHMS.

Sec.	20 ^m	21 ^m	22 ^m	23 ^m	24 ^m	25 ^m	26 ^m	27 ^m	28 ^m	29 ^m
0	.47712	.45593	.43573	.41642	.39794	.38021	.36318	.34679	.33099	.31575
2	.47640	.45524	.43507	.41580	.39734	.37963	.36262	.34625	.33048	.31526
4	.47568	.45456	.43442	.41517	.39674	.37906	.36207	.34572	.32996	.31476
6	.47496	.45387	.43376	.41454	.39614	.37848	.36151	.34518	.32945	.31426
8	.47424	.45318	.43311	.41391	.39554	.37790	.36096	.34465	.32893	.31376
10	.47352	.45250	.43245	.41329	.39494	.37733	.36040	.34412	.32842	.31327
12	.47280	.45182	.43180	.41266	.39434	.37675	.35985	.34358	.32790	.31277
14	.47209	.45113	.43115	.41204	.39374	.37618	.35930	.34305	.32739	.31227
16	.47137	.45045	.43050	.41142	.39314	.37560	.35875	.34252	.32688	.31178
18	.47066	.44977	.42985	.41080	.39255	.37503	.35820	.34199	.32637	.31126
20	.46994	.44909	.42920	.41018	.39195	.37446	.35765	.34146	.32585	.31079
22	.46923	.44842	.42855	.40956	.39136	.37389	.35710	.34093	.32534	.31030
24	.46852	.44774	.42790	.40894	.39076	.37332	.35655	.34040	.32483	.30981
26	.46781	.44706	.42726	.40832	.39017	.37275	.35600	.33987	.32432	.30931
28	.46711	.44639	.42661	.40770	.38958	.37218	.35545	.33935	.32382	.30882
30	.46640	.44571	.42597	.40708	.38899	.37161	.35491	.33882	.32331	.30833
32	.46569	.44504	.42533	.40647	.38840	.37104	.35436	.33829	.32280	.30784
34	.46499	.44437	.42469	.40585	.38781	.37048	.35382	.33777	.32229	.30735
36	.46429	.44370	.42404	.40524	.38722	.36991	.35327	.33724	.32179	.30686
38	.46358	.44303	.42340	.40463	.38663	.36935	.35273	.33672	.32128	.30637
40	.46288	.44236	.42276	.40402	.38604	.36878	.35218	.33620	.32078	.30588
42	.46218	.44169	.42213	.40340	.38546	.36822	.35164	.33567	.32027	.30540
44	.46148	.44103	.42149	.40279	.38487	.36766	.35110	.33515	.31977	.30491
46	.46079	.44036	.42085	.40218	.38428	.36709	.35056	.33463	.31926	.30442
48	.46009	.43970	.42022	.40158	.38370	.36653	.35002	.33411	.31876	.30394
50	.45939	.43903	.41958	.40097	.38312	.36597	.34948	.33359	.31826	.30345
52	.45870	.43837	.41895	.40036	.38253	.36541	.34894	.33307	.31776	.30297
54	.45801	.43771	.41832	.39975	.38195	.36485	.34840	.33255	.31725	.30248
56	.45731	.43705	.41769	.39915	.38137	.36429	.34786	.33203	.31675	.30200
58	.45662	.43639	.41705	.39854	.38079	.36374	.34733	.33151	.31625	.30151
60	.45593	.43573	.41642	.39794	.38021	.36318	.34679	.33099	.31575	.30103

Sec.	30 ^m	31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m
0	.30103	.28679	.27300	.25964	.24667	.23408	.22185	.20995	.19837	.18709
2	.30055	.28632	.27255	.25920	.24625	.23367	.22145	.20956	.19799	.18672
4	.30007	.28586	.27210	.25876	.24582	.23326	.22105	.20917	.19761	.18635
6	.29959	.28539	.27165	.25832	.24540	.23285	.22065	.20878	.19723	.18598
8	.29911	.28493	.27120	.25789	.24497	.23243	.22024	.20839	.19685	.18561
10	.29863	.28446	.27075	.25745	.24455	.23202	.21984	.20800	.19647	.18524
12	.29815	.28400	.27030	.25701	.24413	.23161	.21944	.20761	.19609	.18487
14	.29767	.28353	.26985	.25658	.24370	.23120	.21904	.20722	.19571	.18450
16	.29719	.28307	.26940	.25614	.24328	.23079	.21864	.20683	.19533	.18413
18	.29671	.28261	.26895	.25571	.24286	.23038	.21825	.20644	.19495	.18376
20	.29623	.28215	.26850	.25527	.24244	.22997	.21785	.20606	.19458	.18339
22	.29576	.28168	.26805	.25484	.24202	.22956	.21745	.20567	.19420	.18302
24	.29528	.28122	.26761	.25441	.24159	.22915	.21705	.20528	.19382	.18266
26	.29480	.28076	.26716	.25397	.24117	.22874	.21665	.20489	.19344	.18229
28	.29433	.28030	.26671	.25354	.24075	.22833	.21626	.20451	.19307	.18192
30	.29385	.27984	.26627	.25311	.24033	.22792	.21586	.20412	.19269	.18156
32	.29338	.27938	.26582	.25268	.23991	.22752	.21546	.20374	.19232	.18119
34	.29290	.27892	.26538	.25224	.23949	.22711	.21507	.20335	.19194	.18082
36	.29243	.27847	.26493	.25181	.23908	.22670	.21467	.20297	.19157	.18046
38	.29196	.27801	.26449	.25138	.23866	.22630	.21428	.20258	.19119	.18009
40	.29149	.27755	.26405	.25095	.23824	.22589	.21388	.20220	.19082	.17973
42	.29101	.27709	.26360	.25052	.23782	.22548	.21349	.20181	.19044	.17936
44	.29054	.27664	.26316	.25009	.23741	.22508	.21309	.20143	.19007	.17900
46	.29007	.27618	.26272	.24966	.23699	.22467	.21270	.20104	.18969	.17863
48	.28960	.27573	.26228	.24924	.23657	.22427	.21230	.20066	.18932	.17827
50	.28913	.27527	.26184	.24881	.23616	.22387	.21191	.20028	.18895	.17791
52	.28866	.27482	.26140	.24838	.23574	.22346	.21152	.19990	.18858	.17754
54	.28819	.27436	.26096	.24795	.23533	.22306	.21113	.19951	.18820	.17718
56	.28773	.27391	.26052	.24753	.23491	.22265	.21073	.19913	.18783	.17682
58	.28726	.27346	.26008	.24710	.23450	.22225	.21034	.19875	.18746	.17645
60	.28679	.27300	.25964	.24667	.23408	.22185	.20995	.19837	.18709	.17609

LOGISTIC LOGARITHMS.

Sec.	40 ^m	41 ^m	42 ^m	43 ^m	44 ^m	45 ^m	46 ^m	47 ^m	48 ^m	49 ^m
0	.17609	.16537	.15490	.14468	.13470	.12494	.11539	.10605	.09691	.08796
2	.17573	.16502	.15456	.14435	.13437	.12462	.11508	.10575	.09661	.08766
4	.17537	.16466	.15421	.14401	.13404	.12430	.11477	.10544	.09631	.08737
6	.17501	.16431	.15387	.14368	.13371	.12398	.11445	.10513	.09601	.08707
8	.17465	.16396	.15353	.14334	.13339	.12366	.11414	.10482	.09571	.08678
10	.17429	.16361	.15318	.14300	.13306	.12333	.11382	.10452	.09541	.08648
12	.17393	.16326	.15284	.14267	.13273	.12301	.11351	.10421	.09511	.08619
14	.17357	.16290	.15250	.14233	.13240	.12269	.11320	.10390	.09481	.08589
16	.17321	.16255	.15215	.14200	.13208	.12237	.11288	.10360	.09451	.08560
18	.17286	.16220	.15181	.14166	.13175	.12205	.11257	.10329	.09421	.08531
20	.17249	.16185	.15147	.14133	.13142	.12173	.11226	.10299	.09391	.08501
22	.17213	.16150	.15113	.14100	.13110	.12142	.11195	.10268	.09361	.08472
24	.17177	.16115	.15079	.14066	.13077	.12110	.11163	.10237	.09331	.08443
26	.17141	.16080	.15045	.14033	.13044	.12078	.11132	.10207	.09301	.08413
28	.17106	.16045	.15010	.14000	.13012	.12046	.11101	.10176	.09271	.08384
30	.17070	.16010	.14976	.13966	.12979	.12014	.11070	.10146	.09241	.08355
32	.17034	.15976	.14942	.13933	.12947	.11982	.11039	.10115	.09211	.08325
34	.16998	.15941	.14908	.13900	.12914	.11951	.11008	.10085	.09181	.08296
36	.16963	.15906	.14874	.13867	.12882	.11919	.10977	.10055	.09152	.08267
38	.16927	.15871	.14840	.13833	.12849	.11887	.10946	.10024	.09122	.08238
40	.16891	.15836	.14806	.13800	.12817	.11855	.10915	.09994	.09092	.08209
42	.16856	.15802	.14773	.13767	.12784	.11824	.10884	.09963	.09062	.08180
44	.16820	.15767	.14739	.13734	.12752	.11792	.10853	.09933	.09033	.08150
46	.16785	.15732	.14705	.13701	.12720	.11760	.10822	.09903	.09003	.08121
48	.16749	.15698	.14671	.13668	.12687	.11729	.10791	.09872	.08973	.08092
50	.16714	.15663	.14637	.13635	.12655	.11697	.10760	.09842	.08944	.08063
52	.16678	.15628	.14603	.13602	.12623	.11666	.10729	.09812	.08914	.08034
54	.16643	.15594	.14570	.13569	.12591	.11634	.10698	.09782	.08884	.08005
56	.16608	.15559	.14536	.13536	.12558	.11602	.10667	.09751	.08855	.07976
58	.16572	.15525	.14502	.13503	.12526	.11571	.10636	.09721	.08825	.07947
60	.16537	.15490	.14468	.13470	.12494	.11539	.10605	.09691	.08796	.07918

Sec.	50 ^m	51 ^m	52 ^m	53 ^m	54 ^m	55 ^m	56 ^m	57 ^m	58 ^m	59 ^m
0	.07918	.07058	.06215	.05388	.04576	.03779	.02996	.02228	.01472	.00730
2	.07889	.07030	.06187	.05360	.04549	.03753	.02971	.02202	.01447	.00706
4	.07860	.07002	.06159	.05333	.04522	.03726	.02945	.02177	.01423	.00681
6	.07831	.06973	.06131	.05306	.04496	.03700	.02919	.02152	.01398	.00657
8	.07803	.06945	.06104	.05279	.04469	.03674	.02893	.02126	.01373	.00632
10	.07774	.06917	.06076	.05251	.04442	.03648	.02867	.02101	.01348	.00608
12	.07745	.06888	.06048	.05224	.04415	.03621	.02842	.02076	.01323	.00583
14	.07716	.06860	.06020	.05197	.04389	.03595	.02816	.02050	.01298	.00559
16	.07687	.06832	.05993	.05170	.04362	.03569	.02790	.02025	.01273	.00534
18	.07658	.06804	.05965	.05143	.04335	.03543	.02764	.02000	.01248	.00510
20	.07630	.06775	.05937	.05115	.04309	.03517	.02739	.01975	.01224	.00485
22	.07601	.06747	.05910	.05088	.04282	.03490	.02713	.01949	.01199	.00461
24	.07572	.06719	.05882	.05061	.04255	.03464	.02687	.01924	.01174	.00437
26	.07543	.06691	.05855	.05034	.04229	.03438	.02662	.01899	.01149	.00412
28	.07515	.06663	.05827	.05007	.04202	.03412	.02636	.01874	.01124	.00388
30	.07486	.06635	.05799	.04980	.04176	.03386	.02610	.01848	.01100	.00364
32	.07457	.06606	.05772	.04953	.04150	.03360	.02585	.01823	.01075	.00339
34	.07429	.06578	.05744	.04926	.04123	.03334	.02559	.01798	.01050	.00315
36	.07400	.06550	.05717	.04899	.04096	.03308	.02534	.01773	.01025	.00291
38	.07372	.06522	.05689	.04872	.04069	.03282	.02508	.01748	.01001	.00266
40	.07343	.06494	.05662	.04845	.04043	.03256	.02482	.01723	.00976	.00242
42	.07314	.06466	.05634	.04818	.04017	.03230	.02457	.01698	.00951	.00218
44	.07286	.06438	.05607	.04791	.03990	.03204	.02431	.01673	.00927	.00194
46	.07257	.06410	.05579	.04764	.03964	.03178	.02406	.01648	.00902	.00169
48	.07229	.06382	.05552	.04737	.03937	.03152	.02380	.01622	.00878	.00145
50	.07200	.06354	.05524	.04710	.03911	.03126	.02355	.01597	.00853	.00121
52	.07172	.06326	.05497	.04683	.03884	.03100	.02329	.01572	.00828	.00097
54	.07143	.06300	.05470	.04656	.03858	.03074	.02304	.01547	.00804	.00073
56	.07115	.06271	.05442	.04630	.03832	.03048	.02279	.01522	.00779	.00048
58	.07087	.06243	.05415	.04603	.03805	.03022	.02253	.01497	.00755	.00024
60	.07058	.06215	.05388	.04576	.03779	.02996	.02228	.01472	.00730	.00000

Greenwich Date Logarithm for the Moon. (p.)

Min.	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	Min.
0		1.07918	.77815	.60206	.47712	.38021	.30103	.23408	.17609	.12494	.07918	.03779	0
1	2.85733	1.07200	.77455	.59966	.47532	.37877	.29983	.23305	.17519	.12414	.07846	.03713	1
2	2.55630	1.06494	.77097	.59726	.47352	.37733	.29863	.23202	.17429	.12333	.07774	.03648	2
3	2.38021	1.05799	.76743	.59488	.47173	.37589	.29743	.23099	.17339	.12253	.07702	.03582	3
4	2.25527	1.05115	.76391	.59252	.46994	.37446	.29623	.22997	.17249	.12173	.07630	.03517	4
5	2.15836	1.04442	.76042	.59016	.46817	.37303	.29504	.22894	.17159	.12094	.07558	.03451	5
6	2.07918	1.03779	.75696	.58782	.46640	.37161	.29385	.22792	.17070	.12014	.07486	.03386	6
7	2.01224	1.03126	.75353	.58549	.46464	.37020	.29267	.22691	.16980	.11935	.07415	.03321	7
8	1.95424	1.02482	.75012	.58318	.46288	.36878	.29149	.22589	.16891	.11855	.07343	.03256	8
9	1.90309	1.01848	.74674	.58087	.46113	.36738	.29031	.22488	.16802	.11776	.07272	.03191	9
10	1.85733	1.01224	.74339	.57858	.45939	.36597	.28913	.22387	.16714	.11697	.07200	.03126	10
11	1.81594	1.00608	.74006	.57630	.45766	.36457	.28796	.22286	.16625	.11618	.07129	.03061	11
12	1.77815	1.00000	.73676	.57403	.45593	.36318	.28679	.22185	.16537	.11539	.07058	.02996	12
13	1.74339	.99401	.73348	.57178	.45421	.36179	.28562	.22085	.16449	.11461	.06987	.02932	13
14	1.71121	.98810	.73023	.56953	.45250	.36040	.28446	.21984	.16361	.11382	.06917	.02867	14
15	1.68124	.98227	.72700	.56730	.45079	.35902	.28330	.21884	.16273	.11304	.06846	.02803	15
16	1.65321	.97652	.72379	.56508	.44909	.35765	.28215	.21785	.16185	.11226	.06775	.02739	16
17	1.62688	.97084	.72061	.56287	.44740	.35627	.28099	.21685	.16098	.11148	.06705	.02675	17
18	1.60206	.96524	.71745	.56067	.44571	.35491	.27984	.21586	.16010	.11070	.06635	.02610	18
19	1.57858	.95971	.71432	.55848	.44403	.35354	.27869	.21487	.15923	.10992	.06564	.02546	19
20	1.55630	.95424	.71121	.55630	.44236	.35218	.27755	.21388	.15836	.10915	.06494	.02482	20
21	1.53511	.94885	.70811	.55414	.44069	.35083	.27641	.21290	.15750	.10837	.06424	.02419	21
22	1.51491	.94352	.70505	.55198	.43903	.34948	.27527	.21191	.15663	.10760	.06354	.02355	22
23	1.49561	.93826	.70200	.54984	.43738	.34813	.27413	.21093	.15577	.10683	.06285	.02291	23
24	1.47712	.93305	.69897	.54770	.43573	.34679	.27300	.20995	.15490	.10606	.06215	.02228	24
25	1.45939	.92791	.69597	.54558	.43409	.34545	.27187	.20897	.15404	.10529	.06145	.02164	25
26	1.44236	.92284	.69298	.54347	.43245	.34412	.27075	.20800	.15318	.10452	.06076	.02101	26
27	1.42597	.91781	.69002	.54136	.43082	.34279	.26962	.20703	.15233	.10375	.06007	.02038	27
28	1.41018	.91285	.68707	.53927	.42920	.34146	.26850	.20606	.15147	.10299	.05937	.01975	28
29	1.39494	.90794	.68415	.53719	.42758	.34014	.26738	.20509	.15062	.10222	.05868	.01911	29
30	1.38021	.90309	.68124	.53511	.42597	.33882	.26627	.20412	.14976	.10146	.05799	.01848	30
31	1.36597	.89829	.67836	.53305	.42436	.33751	.26516	.20316	.14891	.10070	.05730	.01786	31
32	1.35218	.89355	.67549	.53100	.42276	.33620	.26405	.20220	.14806	.09994	.05662	.01723	32
33	1.33882	.88885	.67264	.52895	.42117	.33489	.26294	.20124	.14722	.09918	.05593	.01660	33
34	1.32585	.88421	.66981	.52692	.41958	.33359	.26184	.20028	.14637	.09842	.05524	.01597	34
35	1.31327	.87961	.66700	.52490	.41800	.33229	.26074	.19932	.14553	.09767	.05456	.01535	35
36	1.30103	.87506	.66421	.52288	.41642	.33099	.25964	.19837	.14468	.09691	.05388	.01472	36
37	1.28913	.87056	.66143	.52087	.41485	.32970	.25854	.19742	.14384	.09616	.05319	.01410	37
38	1.27755	.86611	.65868	.51888	.41329	.32842	.25745	.19647	.14300	.09541	.05251	.01348	38
39	1.26627	.86170	.65594	.51689	.41173	.32713	.25636	.19552	.14217	.09466	.05183	.01286	39
40	1.25527	.85733	.65321	.51491	.41018	.32585	.25527	.19458	.14133	.09391	.05115	.01224	40
41	1.24455	.85301	.65051	.51294	.40863	.32458	.25419	.19363	.14050	.09316	.05048	.01162	41
42	1.23408	.84873	.64782	.51098	.40708	.32331	.25311	.19269	.13966	.09241	.04980	.01100	42
43	1.22387	.84451	.64515	.50903	.40555	.32204	.25203	.19175	.13883	.09167	.04912	.01038	43
44	1.21388	.84030	.64249	.50709	.40402	.32078	.25095	.19082	.13800	.09092	.04845	.00976	44
45	1.20412	.83614	.63985	.50515	.40249	.31951	.24988	.18988	.13717	.09018	.04777	.00914	45
46	1.19458	.83203	.63723	.50323	.40097	.31826	.24881	.18895	.13635	.08944	.04710	.00853	46
47	1.18524	.82795	.63462	.50131	.39945	.31700	.24774	.18802	.13552	.08870	.04643	.00791	47
48	1.17609	.82391	.63202	.49940	.39794	.31575	.24667	.18709	.13470	.08796	.04576	.00730	48
49	1.16714	.81991	.62945	.49750	.39644	.31451	.24561	.18616	.13388	.08722	.04509	.00669	49
50	1.15836	.81594	.62688	.49561	.39494	.31327	.24455	.18524	.13306	.08648	.04442	.00608	50
51	1.14976	.81201	.62434	.49372	.39344	.31203	.24349	.18431	.13224	.08575	.04375	.00546	51
52	1.14133	.80812	.62181	.49185	.39195	.31079	.24244	.18339	.13142	.08501	.04309	.00485	52
53	1.13306	.80426	.61929	.48998	.39047	.30956	.24138	.18247	.13061	.08428	.04242	.00424	53
54	1.12494	.80043	.61678	.48812	.38899	.30833	.24033	.18156	.12979	.08355	.04176	.00364	54
55	1.11697	.79664	.61430	.48627	.38751	.30711	.23929	.18064	.12898	.08282	.04109	.00303	55
56	1.10915	.79288	.61182	.48442	.38604	.30588	.23824	.17973	.12817	.08209	.04043	.00242	56
57	1.10146	.78915	.60936	.48259	.38458	.30467	.23720	.17882	.12736	.08136	.03977	.00181	57
58	1.09391	.78545	.60691	.48076	.38312	.30345	.23616	.17791	.12655	.08063	.03911	.00121	58
59	1.08648	.78179	.60448	.47894	.38166	.30224	.23512	.17700	.12574	.07991	.03845	.00060	59

Greenwich Date Logarithm for the SUN. (q.)

Min.	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	Min
0		1.38021	1.07918	.90309	.77815	.68124	.60206	.53511	.47712	.42597	.38021	.33882	0
1	3.15836	1.37303	1.07558	.90069	.77635	.67980	.60086	.53408	.47622	.42517	.37949	.33816	1
2	2.85733	1.36597	1.07200	.89829	.77455	.67836	.59966	.53305	.47532	.42436	.37877	.33751	2
3	2.68124	1.35902	1.06846	.89591	.77276	.67692	.59846	.53202	.47442	.42356	.37805	.33685	3
4	2.55630	1.35218	1.06494	.89355	.77097	.67549	.59726	.53090	.47352	.42276	.37733	.33620	4
5	2.45939	1.34545	1.06145	.89119	.76920	.67406	.59607	.52997	.47262	.42197	.37661	.33554	5
6	2.38021	1.33882	1.05799	.88885	.76743	.67264	.59488	.52895	.47173	.42117	.37589	.33489	6
7	2.31327	1.33229	1.05456	.88652	.76567	.67123	.59370	.52794	.47083	.42038	.37518	.33424	7
8	2.25527	1.32585	1.05115	.88421	.76391	.66981	.59252	.52692	.46994	.41958	.37446	.33359	8
9	2.20412	1.31951	1.04777	.88190	.76216	.66841	.59134	.52591	.46905	.41879	.37375	.33294	9
10	2.15836	1.31327	1.04442	.87961	.76042	.66700	.59016	.52490	.46817	.41800	.37303	.33229	10
11	2.11697	1.30711	1.04109	.87733	.75869	.66560	.58899	.52389	.46728	.41721	.37232	.33164	11
12	2.07918	1.30103	1.03779	.87506	.75696	.66421	.58782	.52288	.46640	.41642	.37161	.33099	12
13	2.04442	1.29504	1.03451	.87281	.75524	.66282	.58665	.52188	.46552	.41564	.37090	.33035	13
14	2.01224	1.28913	1.03126	.87056	.75353	.66143	.58549	.52087	.46464	.41485	.37020	.32970	14
15	1.98227	1.28330	1.02803	.86833	.75182	.66005	.58433	.51987	.46376	.41407	.36949	.32906	15
16	1.95424	1.27755	1.02482	.86611	.75012	.65868	.58318	.51888	.46288	.41329	.36878	.32842	16
17	1.92791	1.27187	1.02164	.86390	.74843	.65730	.58202	.51788	.46201	.41251	.36808	.32778	17
18	1.90309	1.26627	1.01848	.86170	.74674	.65594	.58087	.51689	.46113	.41173	.36738	.32713	18
19	1.87961	1.26074	1.01535	.85951	.74506	.65457	.57972	.51590	.46026	.41095	.36667	.32649	19
20	1.85733	1.25527	1.01224	.85733	.74339	.65321	.57858	.51491	.45939	.41018	.36597	.32585	20
21	1.83614	1.24988	1.00914	.85517	.74172	.65186	.57744	.51393	.45853	.40940	.36527	.32522	21
22	1.81594	1.24455	1.00608	.85301	.74006	.65051	.57630	.51294	.45766	.40863	.36457	.32458	22
23	1.79664	1.23929	1.00303	.85087	.73841	.64916	.57516	.51196	.45680	.40786	.36388	.32394	23
24	1.77815	1.23408	1.00000	.84873	.73676	.64782	.57403	.51098	.45593	.40709	.36318	.32331	24
25	1.76042	1.22894	.99700	.84661	.73512	.64648	.57290	.51000	.45507	.40632	.36248	.32267	25
26	1.74339	1.22387	.99401	.84450	.73348	.64515	.57178	.50903	.45421	.40555	.36179	.32204	26
27	1.72700	1.21884	.99105	.84239	.73185	.64382	.57065	.50806	.45336	.40478	.36110	.32141	27
28	1.71121	1.21388	.98810	.84030	.73023	.64249	.56953	.50709	.45250	.40402	.36040	.32078	28
29	1.69597	1.20897	.98518	.83822	.72861	.64117	.56841	.50612	.45165	.40325	.35971	.32014	29
30	1.68124	1.20412	.98227	.83614	.72700	.63985	.56730	.50515	.45079	.40249	.35902	.31951	30
31	1.66700	1.19932	.97939	.83408	.72539	.63854	.56619	.50419	.44994	.40173	.35833	.31889	31
32	1.65321	1.19458	.97652	.83203	.72379	.63723	.56508	.50323	.44909	.40097	.35765	.31826	32
33	1.63985	1.18988	.97367	.82998	.72220	.63592	.56397	.50227	.44825	.40021	.35696	.31763	33
34	1.62688	1.18524	.97084	.82795	.72061	.63462	.56287	.50131	.44740	.39945	.35627	.31700	34
35	1.61430	1.18064	.96803	.82593	.71903	.63332	.56177	.50035	.44656	.39870	.35559	.31638	35
36	1.60206	1.17609	.96524	.82391	.71745	.63202	.56067	.49940	.44571	.39794	.35491	.31575	36
37	1.59016	1.17159	.96246	.82190	.71588	.63073	.55957	.49845	.44487	.39719	.35422	.31513	37
38	1.57858	1.16714	.95971	.81991	.71432	.62945	.55848	.49750	.44403	.39644	.35354	.31451	38
39	1.56730	1.16273	.95697	.81792	.71276	.62816	.55739	.49655	.44320	.39569	.35286	.31389	39
40	1.55630	1.15836	.95424	.81594	.71121	.62688	.55630	.49561	.44236	.39494	.35218	.31327	40
41	1.54558	1.15404	.95154	.81397	.70966	.62561	.55522	.49466	.44153	.39419	.35151	.31265	41
42	1.53511	1.14976	.94885	.81201	.70811	.62434	.55414	.49372	.44069	.39344	.35083	.31203	42
43	1.52490	1.14554	.94618	.81006	.70658	.62307	.55306	.49278	.43986	.39270	.35015	.31141	43
44	1.51491	1.14133	.94352	.80812	.70505	.62181	.55198	.49185	.43903	.39195	.34948	.31079	44
45	1.50515	1.13717	.94088	.80618	.70352	.62054	.55091	.49091	.43820	.39121	.34880	.31017	45
46	1.49561	1.13306	.93826	.80426	.70200	.61929	.54984	.48998	.43738	.39047	.34813	.30956	46
47	1.48627	1.12898	.93565	.80234	.70048	.61803	.54877	.48905	.43655	.38973	.34746	.30894	47
48	1.47712	1.12494	.93305	.80043	.69897	.61678	.54770	.48812	.43573	.38899	.34679	.30833	48
49	1.46817	1.12094	.93048	.79853	.69747	.61554	.54664	.48719	.43491	.38825	.34612	.30772	49
50	1.45939	1.11697	.92791	.79664	.69597	.61430	.54558	.48627	.43409	.38751	.34545	.30711	50
51	1.45079	1.11304	.92537	.79475	.69447	.61306	.54452	.48534	.43327	.38678	.34478	.30649	51
52	1.44236	1.10915	.92284	.79288	.69298	.61182	.54347	.48442	.43245	.38604	.34412	.30588	52
53	1.43409	1.10529	.92032	.79101	.69150	.61059	.54241	.48350	.43164	.38531	.34345	.30527	53
54	1.42597	1.10146	.91781	.78915	.69002	.60936	.54136	.48259	.43082	.38458	.34279	.30467	54
55	1.41800	1.09767	.91533	.78730	.68854	.60814	.54032	.48167	.43001	.38385	.34212	.30406	55
56	1.41018	1.09391	.91285	.78545	.68707	.60691	.53927	.48076	.42920	.38312	.34146	.30345	56
57	1.40249	1.09018	.91039	.78362	.68561	.60570	.53823	.47985	.42839	.38239	.34080	.30284	57
58	1.39494	1.08648	.90794	.78179	.68415	.60448	.53719	.47894	.42758	.38166	.34014	.30224	58
59	1.38751	1.08282	.90551	.77997	.68269	.60327	.53615	.47803	.42677	.38094	.33948	.30163	59

Greenwich Date Logarithm for the Sun. (q.)

Min.	12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	Min.
0	.30103	.26627	.23408	.20412	.17609	.14976	.12494	.10146	.07918	.05799	.03779	.01848	0
1	.30043	.26571	.23357	.20364	.17564	.14934	.12454	.10108	.07882	.05765	.03746	.01817	1
2	.29983	.26516	.23305	.20316	.17519	.14891	.12414	.10070	.07846	.05730	.03713	.01786	2
3	.29923	.26460	.23254	.20268	.17474	.14849	.12374	.10032	.07810	.05696	.03680	.01754	3
4	.29863	.26405	.23202	.20220	.17429	.14806	.12333	.99994	.07774	.05662	.03648	.01723	4
5	.29803	.26349	.23151	.20172	.17384	.14764	.12293	.99956	.07738	.05627	.03615	.01691	5
6	.29743	.26294	.23099	.20124	.17339	.14722	.12253	.99918	.07702	.05593	.03582	.01660	6
7	.29683	.26239	.23048	.20076	.17294	.14679	.12213	.99880	.07666	.05559	.03549	.01629	7
8	.29623	.26184	.22997	.20028	.17249	.14637	.12173	.99842	.07630	.05524	.03517	.01597	8
9	.29564	.26129	.22946	.19980	.17204	.14595	.12134	.99804	.07594	.05490	.03484	.01566	9
10	.29504	.26074	.22894	.19932	.17159	.14553	.12094	.99767	.07558	.05456	.03451	.01535	10
11	.29445	.26019	.22843	.19885	.17114	.14511	.12054	.99729	.07522	.05422	.03419	.01504	11
12	.29385	.25964	.22792	.19837	.17070	.14468	.12014	.99691	.07486	.05388	.03386	.01472	12
13	.29326	.25909	.22741	.19789	.17025	.14426	.11974	.99653	.07450	.05354	.03353	.01441	13
14	.29267	.25854	.22691	.19742	.16980	.14384	.11935	.99616	.07415	.05319	.03321	.01410	14
15	.29208	.25800	.22640	.19694	.16936	.14342	.11895	.99578	.07379	.05285	.03288	.01379	15
16	.29149	.25745	.22589	.19647	.16891	.14300	.11855	.99541	.07343	.05251	.03256	.01348	16
17	.29090	.25691	.22538	.19599	.16847	.14258	.11816	.99503	.07307	.05217	.03223	.01317	17
18	.29031	.25636	.22488	.19552	.16802	.14217	.11776	.99466	.07272	.05183	.03191	.01286	18
19	.28972	.25582	.22437	.19505	.16758	.14175	.11737	.99428	.07236	.05149	.03158	.01255	19
20	.28913	.25527	.22387	.19458	.16714	.14133	.11697	.99391	.07200	.05115	.03126	.01224	20
21	.28855	.25473	.22336	.19410	.16669	.14091	.11658	.99353	.07165	.05081	.03093	.01193	21
22	.28796	.25419	.22286	.19363	.16625	.14050	.11618	.99316	.07129	.05048	.03061	.01162	22
23	.28737	.25365	.22235	.19316	.16581	.14008	.11579	.99278	.07094	.05014	.03029	.01131	23
24	.28679	.25311	.22185	.19269	.16537	.13966	.11539	.99241	.07058	.04980	.02996	.01100	24
25	.28621	.25257	.22135	.19222	.16493	.13925	.11500	.99204	.07023	.04946	.02964	.01069	25
26	.28562	.25203	.22085	.19175	.16449	.13883	.11461	.99167	.06987	.04912	.02932	.01038	26
27	.28504	.25149	.22034	.19128	.16405	.13842	.11422	.99129	.06952	.04879	.02900	.01007	27
28	.28446	.25095	.21984	.19082	.16361	.13800	.11382	.99092	.06917	.04845	.02867	.00976	28
29	.28388	.25042	.21934	.19035	.16317	.13759	.11343	.99055	.06881	.04811	.02835	.00945	29
30	.28330	.24988	.21884	.18988	.16273	.13717	.11304	.99018	.06846	.04777	.02803	.00914	30
31	.28272	.24934	.21835	.18941	.16229	.13676	.11265	.98981	.06811	.04744	.02771	.00884	31
32	.28215	.24881	.21785	.18895	.16185	.13635	.11226	.98944	.06775	.04710	.02739	.00853	32
33	.28157	.24827	.21735	.18848	.16141	.13594	.11187	.98907	.06740	.04677	.02707	.00822	33
34	.28099	.24774	.21685	.18802	.16098	.13552	.11148	.98870	.06705	.04643	.02675	.00791	34
35	.28042	.24721	.21636	.18755	.16054	.13511	.11109	.98833	.06670	.04609	.02642	.00761	35
36	.27984	.24667	.21586	.18709	.16010	.13470	.11070	.98796	.06635	.04576	.02610	.00730	36
37	.27927	.24614	.21536	.18662	.15967	.13429	.11031	.98759	.06599	.04542	.02578	.00699	37
38	.27869	.24561	.21487	.18616	.15923	.13388	.10992	.98722	.06564	.04509	.02546	.00669	38
39	.27812	.24508	.21437	.18570	.15880	.13347	.10953	.98685	.06529	.04475	.02514	.00638	39
40	.27755	.24455	.21388	.18524	.15836	.13306	.10915	.98648	.06494	.04442	.02482	.00608	40
41	.27698	.24402	.21339	.18477	.15793	.13265	.10876	.98611	.06459	.04409	.02451	.00577	41
42	.27641	.24349	.21290	.18431	.15750	.13224	.10837	.98575	.06424	.04375	.02419	.00546	42
43	.27584	.24296	.21240	.18385	.15706	.13183	.10798	.98538	.06389	.04342	.02387	.00516	43
44	.27527	.24244	.21191	.18339	.15663	.13142	.10760	.98501	.06354	.04309	.02355	.00485	44
45	.27470	.24191	.21142	.18293	.15620	.13101	.10721	.98465	.06319	.04275	.02323	.00455	45
46	.27413	.24138	.21093	.18247	.15577	.13061	.10683	.98428	.06285	.04242	.02291	.00424	46
47	.27357	.24086	.21044	.18201	.15533	.13020	.10644	.98391	.06250	.04209	.02260	.00394	47
48	.27300	.24033	.20995	.18155	.15490	.12979	.10605	.98355	.06215	.04176	.02228	.00364	48
49	.27244	.23981	.20946	.18110	.15447	.12939	.10567	.98318	.06180	.04142	.02196	.00333	49
50	.27187	.23929	.20897	.18064	.15404	.12898	.10529	.98282	.06145	.04109	.02164	.00303	50
51	.27131	.23876	.20849	.18018	.15361	.12857	.10490	.98245	.06111	.04076	.02133	.00272	51
52	.27075	.23824	.20800	.17973	.15318	.12817	.10452	.98209	.06076	.04043	.02101	.00242	52
53	.27018	.23772	.20751	.17927	.15275	.12776	.10413	.98172	.06041	.04010	.02069	.00212	53
54	.26962	.23720	.20703	.17882	.15233	.12736	.10375	.98136	.06007	.03977	.02038	.00181	54
55	.26906	.23668	.20654	.17836	.15190	.12696	.10337	.98100	.05972	.03944	.02006	.00151	55
56	.26850	.23616	.20606	.17791	.15147	.12655	.10299	.98063	.05937	.03911	.01975	.00121	56
57	.26794	.23564	.20557	.17745	.15104	.12615	.10260	.98027	.05903	.03878	.01943	.00091	57
58	.26738	.23512	.20509	.17700	.15062	.12574	.10222	.97991	.05868	.03845	.01911	.00060	58
59	.26683	.23460	.20460	.17655	.15019	.12534	.10184	.97954	.05834	.03812	.01880	.00030	59

Prop. Logarithms for Seconds and Tenths of Seconds.

(qq)

"	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0		5.03342	4.73239	4.55630	4.43136	4.33445	4.25527	4.18833	4.13033	4.07918
1	4.03342	3.99203	3.95424	3.91948	3.88730	3.85733	3.82930	3.80297	3.77815	3.75467
2	3.73239	3.71120	3.69100	3.67170	3.65321	3.63548	3.61845	3.60206	3.58627	3.57103
3	3.55630	3.54206	3.52827	3.51491	3.50194	3.48936	3.47712	3.46522	3.45364	3.44236
4	3.43136	3.42064	3.41017	3.39996	3.38997	3.38021	3.37067	3.36133	3.35218	3.34323
5	3.33445	3.32585	3.31742	3.30915	3.30103	3.29306	3.28524	3.27755	3.27000	3.26257
6	3.25527	3.24809	3.24103	3.23408	3.22724	3.22051	3.21388	3.20735	3.20091	3.19457
7	3.18833	3.18217	3.17609	3.17010	3.16419	3.15836	3.15261	3.14693	3.14133	3.13580
8	3.13033	3.12494	3.11961	3.11435	3.10914	3.10400	3.09893	3.09390	3.08894	3.08403
9	3.07918	3.07438	3.06964	3.06494	3.06030	3.05570	3.05115	3.04665	3.04220	3.03779
10	3.03342	3.02910	3.02482	3.02060	3.01639	3.01223	3.00812	3.00404	3.00000	2.99600
11	2.99203	2.98810	2.98421	2.98035	2.97652	2.97273	2.96897	2.96524	2.96154	2.95788
12	2.95424	2.95064	2.94706	2.94352	2.94000	2.93651	2.93305	2.92962	2.92621	2.92283
13	2.91948	2.91615	2.91285	2.90957	2.90632	2.90309	2.89988	2.89670	2.89354	2.89041
14	2.88730	2.88420	2.88114	2.87809	2.87506	2.87206	2.86907	2.86611	2.86316	2.86024
15	2.85733	2.85445	2.85158	2.84873	2.84590	2.84309	2.84030	2.83752	2.83477	2.83203
16	2.82930	2.82660	2.82391	2.82124	2.81858	2.81594	2.81332	2.81071	2.80811	2.80554
17	2.80297	2.80043	2.79790	2.79538	2.79287	2.79039	2.78791	2.78545	2.78300	2.78057
18	2.77815	2.77575	2.77335	2.77097	2.76861	2.76625	2.76391	2.76158	2.75927	2.75696
19	2.75467	2.75239	2.75012	2.74787	2.74562	2.74339	2.74117	2.73896	2.73676	2.73457
20	2.73239	2.73023	2.72807	2.72593	2.72379	2.72167	2.71956	2.71745	2.71536	2.71328
21	2.71120	2.70914	2.70709	2.70504	2.70301	2.70099	2.69897	2.69696	2.69497	2.69298
22	2.69100	2.68903	2.68707	2.68512	2.68318	2.68124	2.67932	2.67740	2.67549	2.67359
23	2.67170	2.66981	2.66794	2.66607	2.66421	2.66236	2.66051	2.65868	2.65685	2.65502
24	2.65321	2.65141	2.64961	2.64782	2.64603	2.64426	2.64249	2.64073	2.63897	2.63722
25	2.63548	2.63375	2.63202	2.63030	2.62859	2.62688	2.62518	2.62349	2.62180	2.62012
26	2.61845	2.61678	2.61512	2.61347	2.61182	2.61018	2.60854	2.60691	2.60529	2.60367
27	2.60206	2.60045	2.59885	2.59726	2.59567	2.59409	2.59251	2.59094	2.58938	2.58782
28	2.58627	2.58472	2.58317	2.58164	2.58011	2.57858	2.57706	2.57554	2.57403	2.57253
29	2.57103	2.56953	2.56804	2.56656	2.56508	2.56360	2.56213	2.56067	2.55921	2.55775
30	2.55630	2.55486	2.55342	2.55198	2.55055	2.54912	2.54770	2.54629	2.54487	2.54347
31	2.54206	2.54066	2.53927	2.53788	2.53649	2.53511	2.53374	2.53236	2.53100	2.52963
32	2.52827	2.52692	2.52557	2.52422	2.52288	2.52154	2.52021	2.51888	2.51755	2.51623
33	2.51491	2.51360	2.51229	2.51098	2.50968	2.50838	2.50708	2.50579	2.50451	2.50322
34	2.50194	2.50067	2.49940	2.49813	2.49687	2.49560	2.49435	2.49309	2.49184	2.49060
35	2.48936	2.48812	2.48688	2.48565	2.48442	2.48320	2.48197	2.48076	2.47954	2.47833
36	2.47712	2.47592	2.47472	2.47352	2.47232	2.47113	2.46994	2.46876	2.46758	2.46640
37	2.46522	2.46405	2.46288	2.46171	2.46055	2.45939	2.45824	2.45708	2.45593	2.45478
38	2.45364	2.45250	2.45136	2.45022	2.44909	2.44796	2.44684	2.44571	2.44459	2.44347
39	2.44236	2.44125	2.44014	2.43903	2.43793	2.43683	2.43573	2.43463	2.43354	2.43245
40	2.43136	2.43028	2.42920	2.42812	2.42704	2.42597	2.42490	2.42383	2.42276	2.42170
41	2.42064	2.41958	2.41853	2.41747	2.41642	2.41538	2.41433	2.41329	2.41225	2.41121
42	2.41017	2.40914	2.40811	2.40708	2.40606	2.40503	2.40401	2.40300	2.40198	2.40097
43	2.39996	2.39895	2.39794	2.39694	2.39593	2.39493	2.39394	2.39294	2.39195	2.39096
44	2.38997	2.38899	2.38800	2.38702	2.38604	2.38506	2.38409	2.38312	2.38215	2.38118
45	2.38021	2.37925	2.37829	2.37733	2.37637	2.37541	2.37446	2.37351	2.37256	2.37161
46	2.37067	2.36972	2.36878	2.36784	2.36691	2.36597	2.36504	2.36411	2.36318	2.36225
47	2.36133	2.36040	2.35948	2.35856	2.35765	2.35673	2.35582	2.35491	2.35400	2.35309
48	2.35218	2.35128	2.35038	2.34948	2.34858	2.34768	2.34679	2.34589	2.34500	2.34411
49	2.34323	2.34234	2.34146	2.34058	2.33970	2.33882	2.33794	2.33707	2.33619	2.33532
50	2.33445	2.33359	2.33272	2.33186	2.33099	2.33013	2.32927	2.32842	2.32756	2.32671
51	2.32585	2.32500	2.32415	2.32331	2.32246	2.32162	2.32077	2.31993	2.31909	2.31826
52	2.31742	2.31659	2.31575	2.31492	2.31409	2.31326	2.31244	2.31161	2.31079	2.30997
53	2.30915	2.30833	2.30751	2.30670	2.30588	2.30507	2.30426	2.30345	2.30264	2.30183
54	2.30103	2.30023	2.29942	2.29862	2.29782	2.29703	2.29623	2.29544	2.29464	2.29385
55	2.29306	2.29227	2.29148	2.29070	2.28991	2.28913	2.28835	2.28757	2.28679	2.28601
56	2.28524	2.28446	2.28369	2.28292	2.28215	2.28138	2.28061	2.27984	2.27908	2.27831
57	2.27755	2.27679	2.27603	2.27527	2.27451	2.27376	2.27300	2.27225	2.27150	2.27075
58	2.27000	2.26925	2.26850	2.26776	2.26701	2.26627	2.26553	2.26479	2.26405	2.26331
59	2.26257	2.26184	2.26110	2.26037	2.25964	2.25891	2.25818	2.25745	2.25672	2.25600

0^h or 0^o.

PROP. LOGARITHMS. (r.)

0^h or 0^o.

"	0'	1'	2'	3'	4'	5'	6'	7'	"
0		2.25527	1.95424	1.77815	1.65321	1.55630	1.47712	1.41017	0
1	4.03342	2.24809	1.95064	1.77575	1.65141	1.55486	1.47592	1.40914	1
2	3.73239	2.24103	1.94706	1.77335	1.64961	1.55342	1.47472	1.40811	2
3	3.55630	2.23408	1.94352	1.77097	1.64782	1.55198	1.47352	1.40708	3
4	3.43136	2.22724	1.94000	1.76861	1.64603	1.55055	1.47232	1.40606	4
5	3.33445	2.22051	1.93651	1.76625	1.64426	1.54912	1.47113	1.40503	5
6	3.25527	2.21388	1.93305	1.76391	1.64249	1.54770	1.46994	1.40401	6
7	3.18833	2.20735	1.92962	1.76158	1.64073	1.54629	1.46876	1.40300	7
8	3.13033	2.20091	1.92621	1.75927	1.63897	1.54487	1.46758	1.40198	8
9	3.07918	2.19457	1.92283	1.75696	1.63722	1.54347	1.46640	1.40097	9
10	3.03342	2.18833	1.91948	1.75467	1.63548	1.54206	1.46522	1.39996	10
11	2.99203	2.18217	1.91615	1.75239	1.63375	1.54066	1.46405	1.39895	11
12	2.95424	2.17609	1.91285	1.75012	1.63202	1.53927	1.46288	1.39794	12
13	2.91948	2.17010	1.90957	1.74787	1.63030	1.53788	1.46171	1.39694	13
14	2.88730	2.16419	1.90632	1.74562	1.62859	1.53649	1.46055	1.39593	14
15	2.85733	2.15836	1.90309	1.74339	1.62688	1.53511	1.45939	1.39493	15
16	2.82930	2.15261	1.89988	1.74117	1.62518	1.53374	1.45824	1.39394	16
17	2.80297	2.14693	1.89670	1.73896	1.62349	1.53236	1.45708	1.39294	17
18	2.77815	2.14133	1.89354	1.73676	1.62180	1.53100	1.45593	1.39195	18
19	2.75467	2.13580	1.89041	1.73457	1.62012	1.52963	1.45478	1.39096	19
20	2.73239	2.13033	1.88730	1.73239	1.61845	1.52827	1.45364	1.38997	20
21	2.71120	2.12494	1.88420	1.73023	1.61678	1.52692	1.45250	1.38899	21
22	2.69100	2.11961	1.88114	1.72807	1.61512	1.52557	1.45136	1.38800	22
23	2.67170	2.11435	1.87809	1.72593	1.61347	1.52422	1.45022	1.38702	23
24	2.65321	2.10914	1.87506	1.72379	1.61182	1.52288	1.44909	1.38604	24
25	2.63548	2.10400	1.87206	1.72167	1.61018	1.52154	1.44796	1.38506	25
26	2.61845	2.09893	1.86907	1.71956	1.60854	1.52021	1.44684	1.38409	26
27	2.60206	2.09390	1.86611	1.71745	1.60691	1.51888	1.44571	1.38312	27
28	2.58627	2.08894	1.86346	1.71536	1.60529	1.51755	1.44459	1.38215	28
29	2.57103	2.08403	1.86024	1.71328	1.60367	1.51623	1.44347	1.38118	29
30	2.55630	2.07918	1.85733	1.71120	1.60206	1.51491	1.44236	1.38021	30
31	2.54206	2.07438	1.85445	1.70914	1.60045	1.51360	1.44125	1.37925	31
32	2.52827	2.06964	1.85158	1.70709	1.59885	1.51229	1.44014	1.37829	32
33	2.51491	2.06494	1.84873	1.70504	1.59726	1.51098	1.43903	1.37733	33
34	2.50194	2.06030	1.84590	1.70301	1.59567	1.50968	1.43793	1.37637	34
35	2.48936	2.05570	1.84309	1.70099	1.59409	1.50838	1.43683	1.37541	35
36	2.47712	2.05115	1.84030	1.69897	1.59251	1.50708	1.43573	1.37446	36
37	2.46522	2.04665	1.83752	1.69696	1.59094	1.50579	1.43463	1.37351	37
38	2.45364	2.04220	1.83477	1.69497	1.58938	1.50451	1.43354	1.37256	38
39	2.44236	2.03779	1.83203	1.69298	1.58782	1.50322	1.43245	1.37161	39
40	2.43136	2.03342	1.82930	1.69100	1.58627	1.50194	1.43136	1.37067	40
41	2.42064	2.02910	1.82660	1.68903	1.58472	1.50067	1.43028	1.36972	41
42	2.41017	2.02482	1.82391	1.68707	1.58317	1.49940	1.42920	1.36878	42
43	2.39996	2.02060	1.82124	1.68512	1.58164	1.49813	1.42812	1.36784	43
44	2.38997	2.01639	1.81858	1.68318	1.58011	1.49687	1.42704	1.36691	44
45	2.38021	2.01223	1.81594	1.68124	1.57858	1.49560	1.42597	1.36597	45
46	2.37067	2.00812	1.81332	1.67932	1.57706	1.49435	1.42490	1.36504	46
47	2.36133	2.00404	1.81071	1.67740	1.57554	1.49309	1.42383	1.36411	47
48	2.35218	2.00000	1.80811	1.67549	1.57403	1.49184	1.42276	1.36318	48
49	2.34323	1.99600	1.80554	1.67359	1.57253	1.49060	1.42170	1.36225	49
50	2.33445	1.99203	1.80297	1.67170	1.57103	1.48936	1.42064	1.36133	50
51	2.32585	1.98810	1.80043	1.66981	1.56953	1.48812	1.41958	1.36040	51
52	2.31742	1.98421	1.79790	1.66794	1.56804	1.48688	1.41853	1.35948	52
53	2.30915	1.98035	1.79538	1.66607	1.56656	1.48565	1.41747	1.35856	53
54	2.30103	1.97652	1.79287	1.66421	1.56508	1.48442	1.41642	1.35765	54
55	2.29306	1.97273	1.79039	1.66236	1.56360	1.48320	1.41538	1.35673	55
56	2.28524	1.96897	1.78791	1.66051	1.56213	1.48197	1.41433	1.35582	56
57	2.27755	1.96524	1.78545	1.65868	1.56067	1.48076	1.41329	1.35491	57
58	2.27000	1.96151	1.78300	1.65685	1.55921	1.47954	1.41225	1.35400	58
59	2.26257	1.95788	1.78057	1.65503	1.55775	1.47833	1.41121	1.35309	59

0^h or 0^o

PROP. LOGARITHMS. (r.)

0^h or 0^o

"	8'	9	10'	11'	12	13'	14'	15'	"
0	1.35218	1.30103	1.25527	1.21388	1.17609	1.14133	1.10914	1.07918	0
1	1.35128	1.30023	1.25455	1.21322	1.17549	1.14077	1.10863	1.07870	1
2	1.35038	1.29942	1.25383	1.21257	1.17489	1.14022	1.10811	1.07822	2
3	1.34948	1.29862	1.25311	1.21191	1.17429	1.13966	1.10760	1.07774	3
4	1.34858	1.29782	1.25239	1.21126	1.17369	1.13911	1.10708	1.07726	4
5	1.34768	1.29703	1.25167	1.21060	1.17309	1.13855	1.10657	1.07678	5
6	1.34679	1.29623	1.25095	1.20995	1.17249	1.13800	1.10605	1.07630	6
7	1.34589	1.29544	1.25024	1.20930	1.17189	1.13745	1.10554	1.07582	7
8	1.34500	1.29464	1.24952	1.20865	1.17129	1.13690	1.10503	1.07534	8
9	1.34411	1.29385	1.24881	1.20800	1.17070	1.13635	1.10452	1.07486	9
10	1.34323	1.29306	1.24809	1.20735	1.17010	1.13580	1.10406	1.07438	10
11	1.34234	1.29227	1.24738	1.20670	1.16951	1.13525	1.10349	1.07391	11
12	1.34146	1.29148	1.24667	1.20605	1.16891	1.13470	1.10298	1.07343	12
13	1.34058	1.29070	1.24596	1.20541	1.16832	1.13415	1.10247	1.07295	13
14	1.33970	1.28991	1.24526	1.20476	1.16773	1.13360	1.10197	1.07248	14
15	1.33882	1.28913	1.24455	1.20412	1.16714	1.13306	1.10146	1.07200	15
16	1.33794	1.28835	1.24384	1.20348	1.16655	1.13251	1.10095	1.07153	16
17	1.33707	1.28757	1.24314	1.20284	1.16596	1.13197	1.10044	1.07105	17
18	1.33619	1.28679	1.24244	1.20219	1.16537	1.13142	1.09994	1.07058	18
19	1.33532	1.28601	1.24173	1.20155	1.16478	1.13088	1.09943	1.07011	19
20	1.33445	1.28524	1.24103	1.20091	1.16419	1.13033	1.09893	1.06964	20
21	1.33359	1.28446	1.24033	1.20028	1.16361	1.12979	1.09842	1.06916	21
22	1.33272	1.28369	1.23963	1.19964	1.16302	1.12925	1.09792	1.06869	22
23	1.33186	1.28292	1.23894	1.19900	1.16243	1.12871	1.09741	1.06822	23
24	1.33099	1.28215	1.23824	1.19837	1.16185	1.12817	1.09691	1.06775	24
25	1.33013	1.28138	1.23754	1.19773	1.16127	1.12763	1.09641	1.06728	25
26	1.32927	1.28061	1.23685	1.19710	1.16068	1.12709	1.09591	1.06681	26
27	1.32842	1.27984	1.23616	1.19647	1.16010	1.12655	1.09540	1.06634	27
28	1.32756	1.27908	1.23546	1.19584	1.15952	1.12601	1.09490	1.06588	28
29	1.32671	1.27831	1.23477	1.19520	1.15894	1.12548	1.09440	1.06541	29
30	1.32585	1.27755	1.23408	1.19457	1.15836	1.12494	1.09390	1.06494	30
31	1.32500	1.27679	1.23339	1.19395	1.15778	1.12440	1.09341	1.06447	31
32	1.32415	1.27603	1.23271	1.19332	1.15721	1.12387	1.09291	1.06401	32
33	1.32331	1.27527	1.23202	1.19269	1.15663	1.12333	1.09241	1.06354	33
34	1.32246	1.27451	1.23133	1.19206	1.15605	1.12280	1.09191	1.06308	34
35	1.32162	1.27376	1.23065	1.19144	1.15548	1.12227	1.09142	1.06261	35
36	1.32077	1.27300	1.22997	1.19081	1.15490	1.12173	1.09092	1.06215	36
37	1.31993	1.27225	1.22928	1.19019	1.15433	1.12120	1.09042	1.06168	37
38	1.31909	1.27150	1.22860	1.18957	1.15375	1.12067	1.08993	1.06122	38
39	1.31826	1.27075	1.22792	1.18895	1.15318	1.12014	1.08943	1.06076	39
40	1.31742	1.27000	1.22724	1.18833	1.15261	1.11961	1.08894	1.06030	40
41	1.31659	1.26925	1.22657	1.18771	1.15204	1.11908	1.08845	1.05983	41
42	1.31575	1.26850	1.22589	1.18709	1.15147	1.11855	1.08796	1.05937	42
43	1.31492	1.26776	1.22521	1.18647	1.15090	1.11802	1.08746	1.05891	43
44	1.31409	1.26701	1.22454	1.18585	1.15033	1.11750	1.08697	1.05845	44
45	1.31326	1.26627	1.22386	1.18523	1.14976	1.11697	1.08648	1.05799	45
46	1.31244	1.26553	1.22319	1.18462	1.14919	1.11644	1.08599	1.05753	46
47	1.31161	1.26479	1.22252	1.18400	1.14863	1.11592	1.08550	1.05707	47
48	1.31079	1.26405	1.22185	1.18339	1.14806	1.11539	1.08501	1.05662	48
49	1.30997	1.26331	1.22118	1.18278	1.14750	1.11487	1.08452	1.05616	49
50	1.30915	1.26257	1.22051	1.18217	1.14693	1.11435	1.08403	1.05570	50
51	1.30833	1.26184	1.21984	1.18155	1.14637	1.11382	1.08355	1.05524	51
52	1.30751	1.26110	1.21918	1.18094	1.14581	1.11330	1.08306	1.05479	52
53	1.30670	1.26037	1.21851	1.18033	1.14524	1.11278	1.08257	1.05433	53
54	1.30588	1.25964	1.21785	1.17973	1.14468	1.11225	1.08209	1.05388	54
55	1.30507	1.25891	1.21718	1.17912	1.14412	1.11174	1.08160	1.05342	55
56	1.30426	1.25818	1.21652	1.17851	1.14356	1.11122	1.08112	1.05297	56
57	1.30345	1.25745	1.21586	1.17790	1.14300	1.11070	1.08063	1.05251	57
58	1.30264	1.25672	1.21520	1.17730	1.14244	1.11018	1.08015	1.05206	58
59	1.30183	1.25600	1.21454	1.17669	1.14189	1.10966	1.07966	1.05161	59

0^h or 0^o

PROP. LOGARITHMS. (r.)

0^h or 0^o

"	16'	17'	18'	19'	20'	21'	22'	23'	24'	"
0	1.05115	1.02482	1.00000	.97652	.95424	.93305	.91285	.89354	.87506	0
1	1.05070	1.02440	.99960	.97614	.95388	.93271	.91252	.89323	.87476	1
2	1.05025	1.02397	.99920	.97576	.95352	.93236	.91219	.89292	.87446	2
3	1.04980	1.02355	.99880	.97538	.95316	.93202	.91186	.89260	.87416	3
4	1.04935	1.02312	.99839	.97500	.95280	.93168	.91154	.89229	.87386	4
5	1.04890	1.02270	.99799	.97462	.95244	.93133	.91121	.89197	.87356	5
6	1.04845	1.02228	.99759	.97424	.95208	.93099	.91088	.89166	.87326	6
7	1.04800	1.02185	.99719	.97386	.95172	.93065	.91055	.89135	.87296	7
8	1.04755	1.02143	.99679	.97348	.95136	.93030	.91023	.89103	.87266	8
9	1.04710	1.02101	.99640	.97310	.95100	.92996	.90990	.89072	.87236	9
10	1.04665	1.02059	.99600	.97273	.95064	.92962	.90957	.89041	.87206	10
11	1.04620	1.02017	.99560	.97235	.95028	.92928	.90925	.89010	.87176	11
12	1.04576	1.01974	.99520	.97197	.94992	.92894	.90892	.88978	.87146	12
13	1.04531	1.01932	.99480	.97159	.94956	.92860	.90859	.88947	.87116	13
14	1.04486	1.01890	.99441	.97122	.94921	.92825	.90827	.88916	.87086	14
15	1.04442	1.01848	.99401	.97084	.94885	.92791	.90794	.88885	.87056	15
16	1.04397	1.01806	.99361	.97047	.94849	.92757	.90762	.88854	.87026	16
17	1.04353	1.01764	.99322	.97009	.94813	.92723	.90729	.88823	.86996	17
18	1.04308	1.01723	.99282	.96972	.94778	.92689	.90697	.88792	.86967	18
19	1.04264	1.01681	.99243	.96934	.94742	.92655	.90664	.88761	.86937	19
20	1.04220	1.01639	.99203	.96897	.94706	.92621	.90632	.88730	.86907	20
21	1.04175	1.01597	.99164	.96859	.94671	.92587	.90599	.88699	.86877	21
22	1.04131	1.01556	.99124	.96822	.94635	.92554	.90567	.88668	.86848	22
23	1.04087	1.01514	.99085	.96784	.94600	.92520	.90535	.88637	.86818	23
24	1.04043	1.01472	.99045	.96747	.94564	.92486	.90502	.88606	.86788	24
25	1.03999	1.01431	.99006	.96710	.94529	.92452	.90470	.88575	.86759	25
26	1.03955	1.01389	.98967	.96673	.94493	.92418	.90438	.88544	.86729	26
27	1.03911	1.01348	.98928	.96635	.94458	.92385	.90406	.88513	.86699	27
28	1.03867	1.01306	.98888	.96598	.94423	.92351	.90373	.88482	.86670	28
29	1.03823	1.01265	.98849	.96561	.94387	.92317	.90341	.88451	.86640	29
30	1.03779	1.01223	.98810	.96524	.94352	.92283	.90309	.88420	.86611	30
31	1.03735	1.01182	.98771	.96487	.94317	.92250	.90277	.88390	.86581	31
32	1.03691	1.01141	.98732	.96450	.94281	.92216	.90245	.88359	.86552	32
33	1.03647	1.01100	.98693	.96413	.94246	.92183	.90213	.88328	.86522	33
34	1.03604	1.01058	.98654	.96376	.94211	.92149	.90181	.88297	.86493	34
35	1.03560	1.01017	.98615	.96339	.94176	.92115	.90148	.88267	.86463	35
36	1.03516	1.00976	.98576	.96302	.94141	.92082	.90116	.88236	.86434	36
37	1.03473	1.00935	.98537	.96265	.94105	.92048	.90084	.88205	.86404	37
38	1.03429	1.00894	.98498	.96228	.94070	.92015	.90052	.88175	.86375	38
39	1.03386	1.00853	.98459	.96191	.94035	.91981	.90020	.88144	.86346	39
40	1.03342	1.00812	.98421	.96154	.94000	.91948	.89988	.88114	.86316	40
41	1.03299	1.00771	.98382	.96117	.93965	.91915	.89957	.88083	.86287	41
42	1.03256	1.00730	.98343	.96081	.93930	.91881	.89925	.88052	.86258	42
43	1.03212	1.00689	.98304	.96044	.93895	.91848	.89893	.88022	.86228	43
44	1.03169	1.00648	.98266	.96007	.93860	.91815	.89861	.87991	.86199	44
45	1.03126	1.00607	.98227	.95971	.93825	.91781	.89829	.87961	.86170	45
46	1.03083	1.00567	.98189	.95934	.93791	.91748	.89797	.87930	.86140	46
47	1.03039	1.00526	.98150	.95897	.93756	.91715	.89766	.87900	.86111	47
48	1.02996	1.00485	.98111	.95861	.93721	.91682	.89734	.87870	.86082	48
49	1.02953	1.00445	.98073	.95824	.93686	.91648	.89702	.87839	.86053	49
50	1.02910	1.00404	.98035	.95788	.93651	.91615	.89670	.87809	.86024	50
51	1.02867	1.00363	.97996	.95751	.93617	.91582	.89639	.87778	.85995	51
52	1.02824	1.00323	.97958	.95715	.93582	.91549	.89607	.87748	.85965	52
53	1.02781	1.00282	.97919	.95678	.93547	.91516	.89575	.87718	.85936	53
54	1.02739	1.00242	.97881	.95642	.93513	.91483	.89544	.87687	.85907	54
55	1.02696	1.00202	.97843	.95606	.93478	.91450	.89512	.87657	.85878	55
56	1.02653	1.00161	.97805	.95569	.93443	.91417	.89481	.87627	.85849	56
57	1.02610	1.00121	.97766	.95533	.93409	.91384	.89449	.87597	.85820	57
58	1.02568	1.00080	.97728	.95497	.93374	.91351	.89417	.87566	.85791	58
59	1.02525	1.00040	.97690	.95460	.93340	.91318	.89386	.87536	.85762	59

0ⁿ or 0°

PROP. LOGARITHMS. (r.)

0ⁿ or 0°

<i>n</i>	25'	26'	27'	28'	29'	30'	31'	32'	33'	<i>n</i>
0	.85733	.84030	.82391	.80811	.79287	.77815	.76391	.75012	.73676	0
1	.85704	.84002	.82364	.80786	.79262	.77791	.76368	.74990	.73654	1
2	.85675	.83974	.82337	.80760	.79238	.77767	.76344	.74967	.73632	2
3	.85646	.83946	.82311	.80734	.79213	.77743	.76321	.74944	.73610	3
4	.85618	.83919	.82284	.80708	.79188	.77719	.76298	.74922	.73588	4
5	.85589	.83891	.82257	.80683	.79163	.77695	.76274	.74899	.73566	5
6	.85560	.83863	.82230	.80657	.79138	.77671	.76251	.74877	.73544	6
7	.85531	.83835	.82204	.80631	.79113	.77647	.76228	.74854	.73523	7
8	.85502	.83808	.82177	.80605	.79088	.77623	.76205	.74832	.73501	8
9	.85473	.83780	.82150	.80579	.79063	.77599	.76181	.74809	.73479	9
10	.85445	.83752	.82124	.80554	.79039	.77575	.76158	.74787	.73457	10
11	.85416	.83725	.82097	.80528	.79014	.77551	.76135	.74764	.73435	11
12	.85387	.83697	.82070	.80502	.78989	.77527	.76112	.74742	.73413	12
13	.85358	.83670	.82044	.80477	.78964	.77503	.76089	.74719	.73392	13
14	.85330	.83642	.82017	.80451	.78939	.77479	.76065	.74697	.73370	14
15	.85301	.83614	.81991	.80425	.78915	.77455	.76042	.74674	.73348	15
16	.85272	.83587	.81964	.80400	.78890	.77431	.76019	.74652	.73326	16
17	.85244	.83559	.81938	.80374	.78865	.77407	.75996	.74629	.73305	17
18	.85215	.83532	.81911	.80349	.78840	.77383	.75973	.74607	.73283	18
19	.85187	.83504	.81884	.80323	.78816	.77359	.75950	.74585	.73261	19
20	.85158	.83477	.81858	.80297	.78791	.77335	.75927	.74562	.73239	20
21	.85129	.83449	.81832	.80272	.78766	.77311	.75903	.74540	.73218	21
22	.85101	.83422	.81805	.80246	.78742	.77288	.75880	.74517	.73196	22
23	.85072	.83394	.81779	.80221	.78717	.77264	.75857	.74495	.73174	23
24	.85044	.83367	.81752	.80195	.78693	.77240	.75834	.74473	.73153	24
25	.85015	.83339	.81726	.80170	.78668	.77216	.75811	.74450	.73131	25
26	.84987	.83312	.81699	.80144	.78643	.77192	.75788	.74428	.73109	26
27	.84958	.83285	.81673	.80119	.78619	.77169	.75765	.74406	.73088	27
28	.84930	.83257	.81647	.80094	.78594	.77145	.75742	.74383	.73066	28
29	.84902	.83230	.81620	.80068	.78570	.77121	.75719	.74361	.73044	29
30	.84873	.83203	.81594	.80043	.78545	.77097	.75696	.74339	.73023	30
31	.84845	.83175	.81568	.80017	.78521	.77074	.75673	.74317	.73001	31
32	.84816	.83148	.81541	.79992	.78496	.77050	.75650	.74294	.72980	32
33	.84788	.83121	.81515	.79967	.78472	.77026	.75627	.74272	.72958	33
34	.84760	.83094	.81489	.79941	.78447	.77002	.75604	.74250	.72936	34
35	.84732	.83066	.81463	.79916	.78423	.76979	.75581	.74228	.72915	35
36	.84703	.83039	.81436	.79891	.78398	.76955	.75559	.74205	.72893	36
37	.84675	.83012	.81410	.79865	.78374	.76931	.75536	.74183	.72872	37
38	.84647	.82985	.81384	.79840	.78349	.76908	.75513	.74161	.72850	38
39	.84619	.82958	.81358	.79815	.78325	.76884	.75490	.74139	.72829	39
40	.84590	.82930	.81332	.79790	.78300	.76861	.75467	.74117	.72807	40
41	.84562	.82903	.81305	.79764	.78276	.76837	.75444	.74095	.72786	41
42	.84534	.82876	.81279	.79739	.78252	.76813	.75421	.74072	.72764	42
43	.84506	.82849	.81253	.79714	.78227	.76790	.75398	.74050	.72743	43
44	.84478	.82822	.81227	.79689	.78203	.76766	.75376	.74028	.72721	44
45	.84450	.82795	.81201	.79663	.78179	.76743	.75353	.74006	.72700	45
46	.84421	.82768	.81175	.79638	.78154	.76719	.75330	.73984	.72678	46
47	.84393	.82741	.81149	.79613	.78130	.76696	.75307	.73962	.72657	47
48	.84365	.82714	.81123	.79588	.78106	.76672	.75283	.73940	.72636	48
49	.84337	.82687	.81097	.79563	.78081	.76649	.75262	.73918	.72614	49
50	.84309	.82660	.81071	.79538	.78057	.76625	.75239	.73896	.72593	50
51	.84281	.82633	.81045	.79513	.78033	.76602	.75216	.73874	.72571	51
52	.84253	.82606	.81019	.79488	.78009	.76578	.75194	.73852	.72550	52
53	.84225	.82579	.80993	.79463	.77984	.76555	.75171	.73830	.72529	53
54	.84197	.82552	.80967	.79437	.77960	.76531	.75148	.73808	.72507	54
55	.84169	.82525	.80941	.79412	.77936	.76508	.75126	.73786	.72486	55
56	.84141	.82498	.80915	.79387	.77912	.76485	.75103	.73764	.72465	56
57	.84114	.82471	.80889	.79362	.77888	.76461	.75080	.73742	.72443	57
58	.84086	.82445	.80863	.79337	.77863	.76438	.75058	.73720	.72422	58
59	.84058	.82418	.80837	.79312	.77839	.76414	.75035	.73698	.72401	59

0° or 0°

PROP. LOGARITHMS. (r.)

0° or 0°

"	34'	35'	36'	37'	38'	39'	40'	41'	42'	"
0	.72379	.71120	.69897	.68707	.67549	.66421	.65321	.64249	.63202	0
1	.72358	.71100	.69877	.68688	.67530	.66402	.65303	.64231	.63185	1
2	.72337	.71079	.69857	.68668	.67511	.66384	.65285	.64214	.63168	2
3	.72316	.71058	.69837	.68648	.67492	.66365	.65267	.64196	.63151	3
4	.72294	.71038	.69817	.68629	.67473	.66347	.65249	.64178	.63133	4
5	.72273	.71017	.69797	.68609	.67454	.66328	.65231	.64161	.63116	5
6	.72252	.70997	.69777	.68590	.67435	.66310	.65213	.64143	.63099	6
7	.72231	.70976	.69756	.68570	.67416	.66291	.65195	.64125	.63082	7
8	.72209	.70955	.69736	.68551	.67397	.66273	.65177	.64108	.63065	8
9	.72188	.70935	.69716	.68531	.67378	.66254	.65159	.64090	.63047	9
10	.72167	.70914	.69696	.68512	.67359	.66236	.65141	.64073	.63030	10
11	.72146	.70894	.69676	.68492	.67340	.66217	.65123	.64055	.63013	11
12	.72125	.70873	.69656	.68473	.67321	.66199	.65105	.64038	.62996	12
13	.72103	.70852	.69636	.68454	.67302	.66180	.65087	.64020	.62979	13
14	.72082	.70832	.69616	.68434	.67283	.66162	.65069	.64002	.62962	14
15	.72061	.70811	.69596	.68415	.67264	.66143	.65051	.63985	.62945	15
16	.72040	.70791	.69576	.68395	.67245	.66125	.65033	.63967	.62927	16
17	.72019	.70770	.69557	.68376	.67226	.66106	.65015	.63950	.62910	17
18	.71998	.70750	.69537	.68356	.67207	.66088	.64997	.63932	.62893	18
19	.71977	.70729	.69517	.68337	.67188	.66070	.64979	.63915	.62876	19
20	.71956	.70709	.69497	.68318	.67170	.66051	.64961	.63897	.62859	20
21	.71935	.70688	.69477	.68298	.67151	.66033	.64943	.63880	.62842	21
22	.71914	.70668	.69457	.68279	.67132	.66014	.64925	.63862	.62825	22
23	.71892	.70647	.69437	.68259	.67113	.65996	.64907	.63845	.62808	23
24	.71871	.70627	.69417	.68240	.67094	.65978	.64889	.63827	.62791	24
25	.71850	.70606	.69397	.68221	.67075	.65959	.64871	.63810	.62774	25
26	.71829	.70586	.69377	.68201	.67056	.65941	.64853	.63792	.62757	26
27	.71808	.70566	.69357	.68182	.67038	.65923	.64835	.63775	.62739	27
28	.71787	.70545	.69338	.68163	.67019	.65904	.64818	.63757	.62722	28
29	.71766	.70525	.69318	.68143	.67000	.65886	.64800	.63740	.62705	29
30	.71745	.70504	.69298	.68124	.66981	.65868	.64782	.63722	.62688	30
31	.71724	.70484	.69287	.68105	.66962	.65849	.64764	.63705	.62671	31
32	.71703	.70464	.69258	.68086	.66944	.65831	.64746	.63688	.62654	32
33	.71682	.70443	.69239	.68066	.66925	.65813	.64728	.63670	.62637	33
34	.71661	.70423	.69219	.68047	.66906	.65794	.64710	.63653	.62620	34
35	.71641	.70403	.69199	.68028	.66887	.65776	.64692	.63635	.62603	35
36	.71620	.70382	.69179	.68009	.66869	.65758	.64675	.63618	.62586	36
37	.71599	.70362	.69159	.67989	.66850	.65739	.64657	.63601	.62569	37
38	.71578	.70342	.69140	.67970	.66831	.65721	.64639	.63583	.62552	38
39	.71557	.70321	.69120	.67951	.66812	.65703	.64621	.63566	.62535	39
40	.71536	.70301	.69100	.67932	.66794	.65685	.64603	.63548	.62518	40
41	.71515	.70281	.69080	.67912	.66775	.65666	.64586	.63531	.62501	41
42	.71494	.70260	.69061	.67893	.66756	.65648	.64568	.63514	.62485	42
43	.71473	.70240	.69041	.67874	.66737	.65630	.64550	.63496	.62468	43
44	.71453	.70220	.69021	.67855	.66719	.65612	.64532	.63479	.62451	44
45	.71432	.70200	.69002	.67836	.66700	.65594	.64514	.63462	.62434	45
46	.71411	.70179	.68982	.67816	.66681	.65575	.64497	.63444	.62417	46
47	.71390	.70159	.68962	.67797	.66663	.65557	.64479	.63427	.62400	47
48	.71369	.70139	.68942	.67778	.66644	.65539	.64461	.63410	.62383	48
49	.71349	.70119	.68923	.67759	.66625	.65521	.64443	.63392	.62366	49
50	.71328	.70099	.68903	.67740	.66607	.65503	.64426	.63375	.62349	50
51	.71307	.70078	.68884	.67721	.66588	.65484	.64408	.63358	.62332	51
52	.71286	.70058	.68864	.67702	.66570	.65466	.64390	.63340	.62315	52
53	.71265	.70038	.68844	.67682	.66551	.65448	.64373	.63323	.62298	53
54	.71245	.70018	.68825	.67663	.66532	.65430	.64355	.63306	.62282	54
55	.71224	.69998	.68805	.67644	.66514	.65412	.64337	.63289	.62265	55
56	.71203	.69977	.68785	.67625	.66495	.65394	.64320	.63271	.62248	56
57	.71183	.69957	.68766	.67606	.66477	.65376	.64302	.63254	.62231	57
58	.71162	.69937	.68746	.67587	.66458	.65357	.64284	.63237	.62214	58
59	.71141	.69917	.68727	.67568	.66439	.65339	.64267	.63220	.62197	59

0^h or 0°

PROP. LOGARITHMS. (r)

0^h or 0°

"	43'	44'	45'	46'	47'	48'	49'	50'	51'	"
0	.62180	.61182	.60206	.59251	.58317	.57403	.56508	.55630	.54770	0
1	.62164	.61166	.60190	.59236	.58302	.57388	.56493	.55616	.54756	1
2	.62147	.61149	.60174	.59220	.58287	.57373	.56478	.55601	.54742	2
3	.62130	.61133	.60158	.59204	.58271	.57358	.56463	.55587	.54728	3
4	.62113	.61116	.60142	.59189	.58256	.57343	.56449	.55572	.54714	4
5	.62096	.61100	.60126	.59173	.58241	.57328	.56434	.55558	.54699	5
6	.62080	.61083	.60110	.59157	.58225	.57313	.56419	.55543	.54685	6
7	.62063	.61067	.60094	.59141	.58210	.57298	.56404	.55529	.54671	7
8	.62046	.61051	.60078	.59126	.58194	.57283	.56390	.55515	.54657	8
9	.62029	.61034	.60061	.59110	.58179	.57268	.56375	.55500	.54643	9
10	.62012	.61018	.60045	.59094	.58164	.57253	.56360	.55486	.54629	10
11	.61996	.61001	.60029	.59079	.58148	.57238	.56345	.55471	.54614	11
12	.61979	.60985	.60013	.59063	.58133	.57223	.56331	.55457	.54600	12
13	.61962	.60969	.59997	.59047	.58118	.57208	.56316	.55442	.54586	13
14	.61945	.60952	.59981	.59032	.58102	.57193	.56301	.55428	.54572	14
15	.61929	.60936	.59965	.59016	.58087	.57178	.56287	.55414	.54558	15
16	.61912	.60920	.59949	.59000	.58072	.57163	.56272	.55399	.54544	16
17	.61895	.60903	.59933	.58985	.58056	.57148	.56257	.55385	.54530	17
18	.61878	.60887	.59917	.58969	.58041	.57133	.56243	.55370	.54516	18
19	.61862	.60871	.59901	.58953	.58026	.57118	.56228	.55356	.54501	19
20	.61845	.60854	.59885	.58938	.58011	.57103	.56213	.55342	.54487	20
21	.61828	.60838	.59870	.58922	.57995	.57088	.56199	.55327	.54473	21
22	.61812	.60822	.59854	.58907	.57980	.57073	.56184	.55313	.54459	22
23	.61795	.60805	.59838	.58891	.57965	.57058	.56169	.55299	.54445	23
24	.61778	.60789	.59822	.58875	.57949	.57043	.56155	.55284	.54431	24
25	.61762	.60773	.59806	.58860	.57934	.57028	.56140	.55270	.54417	25
26	.61745	.60756	.59790	.58844	.57919	.57013	.56125	.55255	.54403	26
27	.61728	.60740	.59774	.58829	.57904	.56998	.56111	.55241	.54389	27
28	.61712	.60724	.59758	.58813	.57888	.56983	.56096	.55227	.54375	28
29	.61695	.60708	.59742	.58798	.57873	.56968	.56081	.55212	.54361	29
30	.61678	.60691	.59726	.58782	.57858	.56953	.56067	.55198	.54347	30
31	.61662	.60675	.59710	.58766	.57843	.56938	.56052	.55184	.54332	31
32	.61645	.60659	.59694	.58751	.57827	.56923	.56037	.55169	.54318	32
33	.61628	.60642	.59678	.58735	.57812	.56908	.56023	.55155	.54304	33
34	.61612	.60626	.59663	.58720	.57797	.56893	.56008	.55141	.54290	34
35	.61595	.60610	.59647	.58704	.57782	.56879	.55994	.55127	.54276	35
36	.61579	.60594	.59631	.58689	.57767	.56864	.55979	.55112	.54262	36
37	.61562	.60578	.59615	.58673	.57751	.56849	.55964	.55098	.54248	37
38	.61545	.60561	.59599	.58658	.57736	.56834	.55950	.55084	.54234	38
39	.61529	.60545	.59583	.58642	.57721	.56819	.55935	.55069	.54220	39
40	.61512	.60529	.59567	.58627	.57706	.56804	.55921	.55055	.54206	40
41	.61496	.60513	.59551	.58611	.57691	.56789	.55906	.55041	.54192	41
42	.61479	.60496	.59536	.58596	.57675	.56774	.55892	.55026	.54178	42
43	.61463	.60480	.59520	.58580	.57660	.56759	.55877	.55012	.54164	43
44	.61446	.60464	.59504	.58565	.57645	.56745	.55862	.54998	.54150	44
45	.61429	.60448	.59488	.58549	.57630	.56730	.55848	.54984	.54136	45
46	.61413	.60432	.59472	.58534	.57615	.56715	.55833	.54969	.54122	46
47	.61396	.60416	.59457	.58518	.57600	.56700	.55819	.54955	.54108	47
48	.61380	.60399	.59441	.58503	.57584	.56685	.55804	.54941	.54094	48
49	.61363	.60383	.59425	.58487	.57569	.56670	.55790	.54927	.54080	49
50	.61347	.60367	.59409	.58472	.57554	.56656	.55775	.54912	.54066	50
51	.61330	.60351	.59393	.58456	.57539	.56641	.55761	.54898	.54052	51
52	.61314	.60335	.59378	.58441	.57524	.56626	.55746	.54884	.54038	52
53	.61297	.60319	.59362	.58425	.57509	.56611	.55732	.54870	.54024	53
54	.61281	.60303	.59346	.58410	.57494	.56596	.55717	.54855	.54011	54
55	.61264	.60286	.59330	.58395	.57479	.56582	.55703	.54841	.53997	55
56	.61248	.60270	.59314	.58379	.57463	.56567	.55688	.54827	.53983	56
57	.61231	.60254	.59299	.58364	.57448	.56552	.55674	.54813	.53969	57
58	.61215	.60238	.59283	.58348	.57433	.56537	.55659	.54799	.53955	58
59	.61198	.60222	.59267	.58333	.57418	.56522	.55645	.54784	.53941	59

0° or 0°

PROP. LOGARITHMS. (r.)

0° or 0°

"	52'	53'	54'	55'	56'	57'	58'	59'	"
0	.53927	.53100	.52288	.51491	.50708	.49940	.49184	.48442	0
1	.53913	.53086	.52274	.51478	.50696	.49927	.49172	.48430	1
2	.53899	.53072	.52261	.51465	.50683	.49914	.49159	.48418	2
3	.53885	.53059	.52248	.51452	.50670	.49902	.49147	.48405	3
4	.53871	.53045	.52234	.51438	.50657	.49889	.49135	.48393	4
5	.53857	.53031	.52221	.51425	.50644	.49876	.49122	.48381	5
6	.53843	.53018	.52208	.51412	.50631	.49864	.49110	.48369	6
7	.53830	.53004	.52194	.51399	.50618	.49851	.49097	.48356	7
8	.53816	.52991	.52181	.51386	.50605	.49838	.49085	.48344	8
9	.53802	.52977	.52167	.51373	.50592	.49826	.49072	.48332	9
10	.53788	.52963	.52154	.51360	.50579	.49813	.49060	.48320	10
11	.53774	.52950	.52141	.51346	.50566	.49800	.49047	.48307	11
12	.53760	.52936	.52127	.51333	.50554	.49788	.49035	.48295	12
13	.53746	.52922	.52114	.51320	.50541	.49775	.49023	.48283	13
14	.53732	.52909	.52101	.51307	.50528	.49762	.49010	.48271	14
15	.53719	.52895	.52087	.51294	.50515	.49750	.48998	.48258	15
16	.53705	.52882	.52074	.51281	.50502	.49737	.48985	.48246	16
17	.53691	.52868	.52061	.51268	.50489	.49724	.48973	.48234	17
18	.53677	.52855	.52047	.51255	.50476	.49712	.48960	.48222	18
19	.53663	.52841	.52034	.51242	.50464	.49699	.48948	.48210	19
20	.53649	.52827	.52021	.51229	.50451	.49687	.48936	.48197	20
21	.53636	.52814	.52007	.51215	.50438	.49674	.48923	.48185	21
22	.53622	.52800	.51994	.51202	.50425	.49661	.48911	.48173	22
23	.53608	.52787	.51981	.51189	.50412	.49649	.48898	.48161	23
24	.53594	.52773	.51967	.51176	.50399	.49636	.48886	.48149	24
25	.53580	.52760	.51954	.51163	.50387	.49623	.48874	.48136	25
26	.53567	.52746	.51941	.51150	.50374	.49611	.48861	.48124	26
27	.53553	.52732	.51927	.51137	.50361	.49598	.48849	.48112	27
28	.53539	.52719	.51914	.51124	.50348	.49586	.48836	.48100	28
29	.53525	.52705	.51901	.51111	.50335	.49573	.48824	.48088	29
30	.53511	.52692	.51888	.51098	.50322	.49560	.48812	.48076	30
31	.53498	.52678	.51874	.51085	.50310	.49548	.48799	.48063	31
32	.53484	.52665	.51861	.51072	.50297	.49535	.48787	.48051	32
33	.53470	.52651	.51848	.51059	.50284	.49523	.48775	.48039	33
34	.53456	.52638	.51835	.51046	.50271	.49510	.48762	.48027	34
35	.53442	.52624	.51821	.51033	.50258	.49498	.48750	.48015	35
36	.53429	.52611	.51808	.51020	.50246	.49485	.48737	.48003	36
37	.53415	.52597	.51795	.51007	.50233	.49472	.48725	.47990	37
38	.53401	.52584	.51781	.50994	.50220	.49460	.48713	.47978	38
39	.53387	.52570	.51768	.50981	.50207	.49447	.48700	.47966	39
40	.53374	.52557	.51755	.50968	.50194	.49435	.48688	.47954	40
41	.53360	.52543	.51742	.50955	.50182	.49422	.48676	.47942	41
42	.53346	.52530	.51729	.50942	.50169	.49410	.48663	.47930	42
43	.53332	.52516	.51715	.50929	.50156	.49397	.48651	.47918	43
44	.53319	.52503	.51702	.50916	.50143	.49385	.48639	.47906	44
45	.53305	.52489	.51689	.50903	.50131	.49372	.48626	.47893	45
46	.53291	.52476	.51676	.50890	.50118	.49360	.48614	.47881	46
47	.53278	.52462	.51662	.50877	.50105	.49347	.48602	.47869	47
48	.53264	.52449	.51649	.50864	.50092	.49334	.48590	.47857	48
49	.53250	.52436	.51636	.50851	.50080	.49322	.48577	.47845	49
50	.53236	.52422	.51623	.50838	.50067	.49309	.48565	.47833	50
51	.53223	.52409	.51610	.50825	.50054	.49297	.48553	.47821	51
52	.53209	.52395	.51596	.50812	.50041	.49284	.48540	.47809	52
53	.53195	.52382	.51583	.50799	.50029	.49272	.48528	.47797	53
54	.53182	.52368	.51570	.50786	.50016	.49259	.48516	.47785	54
55	.53168	.52355	.51557	.50773	.50003	.49247	.48503	.47772	55
56	.53154	.52342	.51544	.50760	.49991	.49234	.48491	.47760	56
57	.53141	.52328	.51530	.50747	.49978	.49222	.48479	.47748	57
58	.53127	.52315	.51517	.50734	.49965	.49209	.48467	.47736	58
59	.53113	.52301	.51504	.50721	.49952	.49197	.48454	.47724	59

1^h or 1^o	PROP. LOGARITHMS. (r.)										1^h or 1^o
"	0'	1'	2'	3'	4'	5'	6'	7'	8'	9'	
0	.47712	.46994	.46288	.45593	.44909	.44236	.43573	.42920	.42276	.41642	
1	.47700	.46982	.46276	.45582	.44898	.44225	.43562	.42909	.42266	.41632	
2	.47688	.46971	.46265	.45570	.44887	.44214	.43551	.42898	.42255	.41621	
3	.47676	.46959	.46253	.45559	.44875	.44203	.43540	.42887	.42244	.41611	
4	.47664	.46947	.46241	.45547	.44864	.44191	.43529	.42877	.42234	.41600	
5	.47652	.46935	.46230	.45536	.44853	.44180	.43518	.42866	.42223	.41590	
6	.47640	.46923	.46218	.45524	.44841	.44169	.43507	.42855	.42213	.41579	
7	.47628	.46911	.46206	.45513	.44830	.44158	.43496	.42844	.42202	.41569	
8	.47616	.46899	.46195	.45501	.44819	.44147	.43485	.42833	.42191	.41559	
9	.47604	.46888	.46183	.45490	.44808	.44136	.43474	.42823	.42181	.41548	
10	.47592	.46876	.46171	.45478	.44796	.44125	.43463	.42812	.42170	.41538	
11	.47580	.46864	.46160	.45467	.44785	.44114	.43452	.42801	.42159	.41527	
12	.47568	.46852	.46148	.45456	.44774	.44102	.43441	.42790	.42149	.41517	
13	.47556	.46840	.46137	.45444	.44762	.44091	.43431	.42780	.42138	.41506	
14	.47544	.46828	.46125	.45433	.44751	.44080	.43420	.42769	.42128	.41496	
15	.47532	.46817	.46113	.45421	.44740	.44069	.43409	.42758	.42117	.41485	
16	.47520	.46805	.46102	.45410	.44729	.44058	.43398	.42747	.42106	.41475	
17	.47508	.46793	.46090	.45398	.44717	.44047	.43387	.42737	.42096	.41464	
18	.47496	.46781	.46078	.45387	.44706	.44036	.43376	.42726	.42085	.41454	
19	.47484	.46769	.46067	.45375	.44695	.44025	.43365	.42715	.42075	.41443	
20	.47472	.46758	.46055	.45364	.44684	.44014	.43354	.42704	.42064	.41433	
21	.47460	.46746	.46044	.45353	.44672	.44003	.43343	.42693	.42053	.41423	
22	.47448	.46734	.46032	.45341	.44661	.43992	.43332	.42683	.42043	.41412	
23	.47436	.46722	.46020	.45330	.44650	.43981	.43321	.42672	.42032	.41402	
24	.47424	.46710	.46009	.45318	.44639	.43969	.43310	.42661	.42022	.41391	
25	.47412	.46699	.45997	.45307	.44627	.43958	.43300	.42651	.42011	.41381	
26	.47400	.46687	.45986	.45295	.44616	.43947	.43289	.42640	.42000	.41370	
27	.47388	.46675	.45974	.45284	.44605	.43936	.43278	.42629	.41990	.41360	
28	.47376	.46663	.45962	.45273	.44594	.43925	.43267	.42618	.41979	.41350	
29	.47364	.46652	.45951	.45261	.44583	.43914	.43256	.42608	.41969	.41339	
30	.47352	.46640	.45939	.45250	.44571	.43903	.43245	.42597	.41958	.41329	
31	.47340	.46628	.45928	.45238	.44560	.43892	.43234	.42586	.41948	.41318	
32	.47328	.46616	.45916	.45227	.44549	.43881	.43223	.42575	.41937	.41308	
33	.47316	.46604	.45905	.45216	.44538	.43870	.43212	.42565	.41927	.41298	
34	.47304	.46593	.45893	.45204	.44526	.43859	.43202	.42554	.41916	.41287	
35	.47292	.46581	.45881	.45193	.44515	.43848	.43191	.42543	.41905	.41277	
36	.47280	.46569	.45870	.45182	.44504	.43837	.43180	.42533	.41895	.41266	
37	.47268	.46557	.45858	.45170	.44493	.43826	.43169	.42522	.41884	.41256	
38	.47256	.46546	.45847	.45159	.44482	.43815	.43158	.42511	.41874	.41246	
39	.47244	.46534	.45835	.45147	.44470	.43804	.43147	.42500	.41863	.41235	
40	.47232	.46522	.45824	.45136	.44459	.43793	.43136	.42490	.41853	.41225	
41	.47220	.46510	.45812	.45125	.44448	.43782	.43126	.42479	.41842	.41214	
42	.47208	.46499	.45800	.45113	.44437	.43771	.43115	.42468	.41832	.41204	
43	.47196	.46487	.45789	.45102	.44426	.43760	.43104	.42458	.41821	.41194	
44	.47185	.46475	.45777	.45091	.44414	.43749	.43093	.42447	.41811	.41183	
45	.47173	.46464	.45766	.45079	.44403	.43738	.43082	.42436	.41800	.41173	
46	.47161	.46452	.45754	.45068	.44392	.43727	.43071	.42426	.41789	.41162	
47	.47149	.46440	.45743	.45057	.44381	.43716	.43060	.42415	.41779	.41152	
48	.47137	.46428	.45731	.45045	.44370	.43705	.43050	.42404	.41768	.41142	
49	.47125	.46417	.45720	.45034	.44359	.43694	.43039	.42394	.41758	.41131	
50	.47113	.46405	.45708	.45022	.44347	.43683	.43028	.42383	.41747	.41121	
51	.47101	.46393	.45697	.45011	.44336	.43672	.43017	.42372	.41737	.41111	
52	.47089	.46382	.45685	.45000	.44325	.43661	.43006	.42362	.41726	.41100	
53	.47077	.46370	.45674	.44988	.44314	.43650	.42995	.42351	.41716	.41090	
54	.47066	.46358	.45662	.44977	.44303	.43639	.42985	.42340	.41705	.41080	
55	.47054	.46346	.45651	.44966	.44292	.43628	.42974	.42330	.41695	.410 9	
56	.47042	.46335	.45639	.44955	.44280	.43617	.42963	.42319	.41684	.41059	
57	.47030	.46323	.45628	.44943	.44269	.43606	.42952	.42308	.41674	.41048	
58	.47018	.46311	.45616	.44932	.44258	.43595	.42941	.42298	.41663	.41038	
59	.47006	.46300	.45605	.44921	.44247	.43584	.42931	.42287	.41653	.41028	

1^h or 1°

PROP. LOGARITHMS. (r.)

1^h or 1°

"	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'
0	.41017	.40401	.39794	.39195	.38604	.38021	.37446	.36878	.36318	.35765
1	.41007	.40391	.39784	.39185	.38594	.38011	.37436	.36869	.36309	.35755
2	.40997	.40381	.39774	.39175	.38585	.38002	.37427	.36859	.36299	.35746
3	.40986	.40371	.39764	.39165	.38575	.37992	.37417	.36850	.36290	.35737
4	.40976	.40361	.39754	.39155	.38565	.37983	.37408	.36841	.36281	.35728
5	.40966	.40350	.39744	.39145	.38555	.37973	.37398	.36831	.36271	.35719
6	.40955	.40340	.39734	.39136	.38545	.37963	.37389	.36822	.36262	.35710
7	.40945	.40330	.39724	.39126	.38536	.37954	.37379	.36812	.36253	.35700
8	.40935	.40320	.39714	.39116	.38526	.37944	.37370	.36803	.36244	.35691
9	.40924	.40310	.39704	.39106	.38516	.37934	.37360	.36794	.36234	.35682
10	.40914	.40300	.39694	.39096	.38506	.37925	.37351	.36784	.36225	.35673
11	.40904	.40289	.39684	.39086	.38497	.37915	.37341	.36775	.36216	.35664
12	.40894	.40279	.39674	.39076	.38487	.37905	.37332	.36766	.36207	.35655
13	.40883	.40269	.39664	.39066	.38477	.37896	.37322	.36756	.36197	.35646
14	.40873	.40259	.39653	.39056	.38467	.37886	.37313	.36747	.36188	.35636
15	.40863	.40249	.39643	.39046	.38458	.37877	.37303	.36737	.36179	.35627
16	.40852	.40239	.39633	.39037	.38448	.37867	.37294	.36728	.36170	.35618
17	.40842	.40228	.39623	.39027	.38438	.37857	.37284	.36719	.36160	.35609
18	.40832	.40218	.39613	.39017	.38428	.37848	.37275	.36709	.36151	.35600
19	.40821	.40208	.39603	.39007	.38419	.37838	.37265	.36700	.36142	.35591
20	.40811	.40198	.39593	.38997	.38409	.37829	.37256	.36691	.36133	.35582
21	.40801	.40188	.39583	.38987	.38399	.37819	.37246	.36681	.36123	.35573
22	.40791	.40178	.39573	.38977	.38389	.37809	.37237	.36672	.36114	.35563
23	.40780	.40168	.39563	.38968	.38380	.37800	.37227	.36663	.36105	.35554
24	.40770	.40157	.39553	.38958	.38370	.37790	.37218	.36653	.36096	.35545
25	.40760	.40147	.39543	.38948	.38360	.37781	.37208	.36644	.36086	.35536
26	.40749	.40137	.39533	.38938	.38351	.37771	.37199	.36634	.36077	.35527
27	.40739	.40127	.39523	.38928	.38341	.37761	.37189	.36625	.36068	.35518
28	.40729	.40117	.39513	.38918	.38331	.37752	.37180	.36616	.36059	.35509
29	.40719	.40107	.39503	.38908	.38321	.37742	.37171	.36606	.36050	.35500
30	.40708	.40097	.39493	.38899	.38312	.37733	.37161	.36597	.36040	.35491
31	.40698	.40087	.39483	.38889	.38302	.37723	.37152	.36588	.36031	.35481
32	.40688	.40076	.39473	.38879	.38292	.37713	.37142	.36578	.36022	.35472
33	.40678	.40066	.39464	.38869	.38282	.37704	.37133	.36569	.36013	.35463
34	.40667	.40056	.39454	.38859	.38273	.37694	.37123	.36560	.36003	.35454
35	.40657	.40046	.39444	.38849	.38263	.37685	.37114	.36550	.35994	.35445
36	.40647	.40036	.39434	.38839	.38253	.37675	.37104	.36541	.35985	.35436
37	.40637	.40026	.39424	.38830	.38244	.37665	.37095	.36532	.35976	.35427
38	.40626	.40016	.39414	.38820	.38234	.37656	.37085	.36522	.35967	.35418
39	.40616	.40006	.39404	.38810	.38224	.37646	.37076	.36513	.35957	.35409
40	.40606	.39996	.39394	.38800	.38215	.37637	.37067	.36504	.35948	.35400
41	.40596	.39985	.39384	.38790	.38205	.37627	.37057	.36494	.35939	.35391
42	.40585	.39975	.39374	.38781	.38195	.37618	.37048	.36485	.35930	.35381
43	.40575	.39965	.39364	.38771	.38186	.37608	.37038	.36476	.35921	.35372
44	.40565	.39955	.39354	.38761	.38176	.37599	.37029	.36467	.35911	.35363
45	.40555	.39945	.39344	.38751	.38166	.37589	.37019	.36457	.35902	.35354
46	.40544	.39935	.39334	.38741	.38156	.37579	.37010	.36448	.35893	.35345
47	.40534	.39925	.39324	.38731	.38147	.37570	.37001	.36439	.35884	.35336
48	.40524	.39915	.39314	.38722	.38137	.37560	.36991	.36429	.35875	.35327
49	.40514	.39905	.39304	.38712	.38127	.37551	.36982	.36420	.35865	.35318
50	.40503	.39895	.39294	.38702	.38118	.37541	.36972	.36411	.35856	.35309
51	.40493	.39885	.39284	.38692	.38108	.37532	.36963	.36401	.35847	.35300
52	.40483	.39874	.39274	.38682	.38098	.37522	.36953	.36392	.35838	.35291
53	.40473	.39864	.39264	.38673	.38089	.37513	.36944	.36383	.35829	.35282
54	.40463	.39854	.39254	.38663	.38079	.37503	.36935	.36374	.35820	.35273
55	.40452	.39844	.39245	.38653	.38069	.37494	.36925	.36364	.35810	.35264
56	.40442	.39834	.39235	.38643	.38060	.37484	.36916	.36355	.35801	.35254
57	.40432	.39824	.39225	.38633	.38050	.37474	.36906	.36346	.35792	.35245
58	.40422	.39814	.39215	.38624	.38040	.37465	.36897	.36336	.35783	.35236
59	.40412	.39804	.39205	.38614	.38031	.37455	.36888	.36327	.35774	.35227

1^h or 1^o.

PROP. LOGARITHMS. (r.)

1^h or 1^o.

"	20'	21'	22'	23'	24'	25'	26'	27'	28'	29'
0	.35218	.34679	.34146	.33619	.33099	.32585	.32077	.31575	.31079	.30588
1	.35209	.34670	.34137	.33611	.33091	.32577	.32069	.31567	.31071	.30580
2	.35200	.34661	.34128	.33602	.33082	.32568	.32061	.31559	.31063	.30572
3	.35191	.34652	.34119	.33593	.33073	.32560	.32052	.31550	.31054	.30564
4	.35182	.34643	.34111	.33585	.33065	.32551	.32044	.31542	.31046	.30556
5	.35173	.34634	.34102	.33576	.33056	.32543	.32035	.31534	.31038	.30548
6	.35164	.34625	.34093	.33567	.33048	.32534	.32027	.31525	.31030	.30539
7	.35155	.34616	.34084	.33558	.33039	.32526	.32019	.31517	.31021	.30531
8	.35146	.34607	.34075	.33550	.33030	.32517	.32010	.31509	.31013	.30523
9	.35137	.34598	.34066	.33541	.33022	.32509	.32002	.31501	.31005	.30515
10	.35128	.34589	.34058	.33532	.33013	.32500	.31993	.31492	.30997	.30507
11	.35119	.34581	.34049	.33524	.33005	.32492	.31985	.31484	.30989	.30499
12	.35110	.34572	.34040	.33515	.32996	.32483	.31977	.31476	.30980	.30491
13	.35101	.34563	.34031	.33506	.32987	.32475	.31968	.31467	.30972	.30483
14	.35092	.34554	.34022	.33498	.32979	.32466	.31960	.31459	.30964	.30475
15	.35083	.34545	.34014	.33489	.32970	.32458	.31951	.31451	.30956	.30466
16	.35074	.34536	.34005	.33480	.32962	.32449	.31943	.31442	.30948	.30458
17	.35065	.34527	.33996	.33471	.32953	.32441	.31935	.31434	.30939	.30450
18	.35056	.34518	.33987	.33463	.32944	.32432	.31926	.31426	.30931	.30442
19	.35047	.34509	.33978	.33454	.32936	.32424	.31918	.31418	.30923	.30434
20	.35038	.34500	.33970	.33445	.32927	.32415	.31909	.31409	.30915	.30426
21	.35029	.34491	.33961	.33437	.32919	.32407	.31901	.31401	.30907	.30418
22	.35020	.34483	.33952	.33428	.32910	.32398	.31893	.31393	.30898	.30410
23	.35011	.34474	.33943	.33419	.32902	.32390	.31884	.31384	.30890	.30402
24	.35002	.34465	.33935	.33411	.32893	.32381	.31876	.31376	.30882	.30393
25	.34993	.34456	.33926	.33402	.32884	.32373	.31867	.31368	.30874	.30385
26	.34984	.34447	.33917	.33393	.32876	.32365	.31859	.31360	.30866	.30377
27	.34975	.34438	.33908	.33385	.32867	.32356	.31851	.31351	.30857	.30369
28	.34966	.34429	.33899	.33376	.32859	.32348	.31842	.31343	.30849	.30361
29	.34957	.34420	.33891	.33367	.32850	.32339	.31834	.31335	.30841	.30353
30	.34948	.34411	.33882	.33359	.32842	.32331	.31826	.31326	.30833	.30345
31	.34939	.34403	.33873	.33350	.32833	.32322	.31817	.31318	.30825	.30337
32	.34930	.34394	.33864	.33341	.32824	.32314	.31809	.31310	.30817	.30329
33	.34921	.34385	.33856	.33333	.32816	.32305	.31801	.31302	.30808	.30321
34	.34912	.34376	.33847	.33324	.32807	.32297	.31792	.31293	.30800	.30313
35	.34903	.34367	.33838	.33315	.32799	.32288	.31784	.31285	.30792	.30305
36	.34894	.34358	.33829	.33307	.32790	.32280	.31775	.31277	.30784	.30296
37	.34885	.34349	.33820	.33298	.32782	.32271	.31767	.31269	.30776	.30288
38	.34876	.34340	.33812	.33289	.32773	.32263	.31759	.31260	.30768	.30280
39	.34867	.34332	.33803	.33281	.32765	.32255	.31750	.31252	.30759	.30272
40	.34858	.34323	.33794	.33272	.32756	.32246	.31742	.31244	.30751	.30264
41	.34849	.34314	.33785	.33263	.32747	.32238	.31734	.31236	.30743	.30256
42	.34840	.34305	.33777	.33255	.32739	.32229	.31725	.31227	.30735	.30248
43	.34831	.34296	.33768	.33246	.32730	.32221	.31717	.31219	.30727	.30240
44	.34822	.34287	.33759	.33237	.32722	.32212	.31709	.31211	.30718	.30232
45	.34813	.34278	.33750	.33229	.32713	.32204	.31700	.31203	.30710	.30224
46	.34804	.34270	.33742	.33220	.32705	.32195	.31692	.31194	.30702	.30216
47	.34795	.34261	.33733	.33211	.32696	.32187	.31684	.31186	.30694	.30208
48	.34786	.34252	.33724	.33203	.32688	.32179	.31675	.31178	.30686	.30200
49	.34777	.34243	.33715	.33194	.32679	.32170	.31667	.31170	.30678	.30192
50	.34768	.34234	.33707	.33186	.32671	.32162	.31659	.31161	.30670	.30183
51	.34759	.34225	.33698	.33177	.32662	.32153	.31650	.31153	.30662	.30175
52	.34750	.34217	.33689	.33168	.32654	.32145	.31642	.31145	.30653	.30167
53	.34741	.34208	.33681	.33160	.32645	.32136	.31634	.31137	.30645	.30159
54	.34732	.34199	.33672	.33151	.32636	.32128	.31625	.31128	.30637	.30151
55	.34723	.34190	.33663	.33142	.32628	.32120	.31617	.31120	.30629	.30143
56	.34715	.34181	.33654	.33134	.32619	.32111	.31609	.31112	.30621	.30135
57	.34706	.34172	.33646	.33125	.32611	.32103	.31600	.31104	.30613	.30127
58	.34697	.34164	.33637	.33117	.32602	.32094	.31592	.31095	.30605	.30119
59	.34688	.34155	.33628	.33108	.32594	.32086	.31584	.31087	.30596	.30111

1^h or 1^o .

PROP. LOGARITHMS. (r.)

 1^h or 1^o .

"	30'	31'	32'	33'	34'	35'	36'	37'	38'	39'
0	.30103	.29623	.29148	.28679	.28214	.27755	.27300	.26850	.26405	.25964
1	.30095	.29615	.29141	.28671	.28207	.27747	.27293	.26843	.26397	.25956
2	.30087	.29607	.29133	.28663	.28199	.27740	.27285	.26835	.26390	.25949
3	.30079	.29599	.29125	.28656	.28191	.27732	.27278	.26828	.26382	.25942
4	.30071	.29591	.29117	.28648	.28184	.27724	.27270	.26820	.26375	.25934
5	.30063	.29583	.29109	.28640	.28176	.27717	.27262	.26813	.26368	.25927
6	.30055	.29575	.29101	.28632	.28168	.27709	.27255	.26805	.26360	.25920
7	.30047	.29567	.29093	.28625	.28161	.27702	.27247	.26798	.26353	.25913
8	.30039	.29560	.29086	.28617	.28153	.27694	.27240	.26790	.26346	.25905
9	.30031	.29552	.29078	.28609	.28145	.27686	.27232	.26783	.26338	.25898
10	.30023	.29544	.29070	.28601	.28138	.27679	.27225	.26775	.26331	.25891
11	.30015	.29536	.29062	.28593	.28130	.27671	.27217	.26768	.26323	.25883
12	.30007	.29528	.29054	.28586	.28122	.27664	.27210	.26761	.26316	.25876
13	.29999	.29520	.29046	.28578	.28114	.27656	.27202	.26753	.26309	.25869
14	.29991	.29512	.29038	.28570	.28107	.27648	.27195	.26746	.26301	.25861
15	.29983	.29504	.29031	.28562	.28099	.27641	.27187	.26738	.26294	.25854
16	.29975	.29496	.29023	.28555	.28091	.27633	.27180	.26731	.26287	.25847
17	.29966	.29488	.29015	.28547	.28084	.27626	.27172	.26723	.26279	.25839
18	.29958	.29480	.29007	.28539	.28076	.27618	.27165	.26716	.26272	.25832
19	.29950	.29472	.28999	.28531	.28068	.27610	.27157	.26709	.26265	.25825
20	.29942	.29464	.28991	.28524	.28061	.27603	.27150	.26701	.26257	.25818
21	.29934	.29456	.28984	.28516	.28053	.27595	.27142	.26694	.26250	.25810
22	.29926	.29448	.28976	.28508	.28045	.27588	.27135	.26686	.26242	.25803
23	.29918	.29441	.28968	.28500	.28038	.27580	.27127	.26679	.26235	.25796
24	.29910	.29433	.28960	.28493	.28030	.27572	.27120	.26671	.26228	.25789
25	.29902	.29425	.28952	.28485	.28022	.27565	.27112	.26664	.26220	.25781
26	.29894	.29417	.28944	.28477	.28015	.27557	.27105	.26656	.26213	.25774
27	.29886	.29409	.28937	.28469	.28007	.27550	.27097	.26649	.26206	.25767
28	.29878	.29401	.28929	.28462	.27999	.27542	.27090	.26642	.26198	.25759
29	.29870	.29393	.28921	.28454	.27992	.27534	.27082	.26634	.26191	.25752
30	.29862	.29385	.28913	.28446	.27984	.27527	.27075	.26627	.26184	.25745
31	.29854	.29377	.28905	.28438	.27976	.27519	.27067	.26619	.26176	.25738
32	.29846	.29369	.28897	.28431	.27969	.27512	.27060	.26612	.26169	.25730
33	.29838	.29361	.28890	.28423	.27961	.27504	.27052	.26605	.26162	.25723
34	.29830	.29354	.28882	.28415	.27953	.27497	.27045	.26597	.26154	.25716
35	.29822	.29346	.28874	.28407	.27946	.27489	.27037	.26590	.26147	.25709
36	.29814	.29338	.28866	.28400	.27938	.27481	.27030	.26582	.26140	.25701
37	.29806	.29330	.28858	.28392	.27930	.27474	.27022	.26575	.26132	.25694
38	.29798	.29322	.28851	.28384	.27923	.27466	.27015	.26567	.26125	.25687
39	.29790	.29314	.28843	.28376	.27915	.27459	.27007	.26560	.26118	.25680
40	.29782	.29306	.28835	.28369	.27908	.27451	.27000	.26553	.26110	.25672
41	.29775	.29298	.28827	.28361	.27900	.27444	.26992	.26545	.26103	.25665
42	.29767	.29290	.28819	.28353	.27892	.27436	.26985	.26538	.26096	.25658
43	.29759	.29282	.28811	.28346	.27885	.27428	.26977	.26530	.26088	.25650
44	.29751	.29275	.28804	.28338	.27877	.27421	.26970	.26523	.26081	.25643
45	.29743	.29267	.28796	.28330	.27869	.27413	.26962	.26516	.26074	.25636
46	.29735	.29259	.28788	.28322	.27862	.27406	.26955	.26508	.26066	.25629
47	.29727	.29251	.28780	.28315	.27854	.27398	.26947	.26501	.26059	.25621
48	.29719	.29243	.28772	.28307	.27846	.27391	.26940	.26493	.26052	.25614
49	.29711	.29235	.28765	.28299	.27839	.27383	.26932	.26486	.26044	.25607
50	.29703	.29227	.28757	.28292	.27831	.27376	.26925	.26479	.26037	.25600
51	.29695	.29219	.28749	.28284	.27824	.27368	.26917	.26471	.26030	.25592
52	.29687	.29211	.28741	.28276	.27816	.27360	.26910	.26464	.26022	.25585
53	.29679	.29204	.28733	.28268	.27808	.27353	.26902	.26456	.26015	.25578
54	.29671	.29196	.28726	.28261	.27801	.27345	.26895	.26449	.26008	.25571
55	.29663	.29188	.28718	.28253	.27793	.27338	.26887	.26442	.26000	.25563
56	.29655	.29180	.28710	.28245	.27785	.27330	.26880	.26434	.25993	.25556
57	.29647	.29172	.28702	.28238	.27778	.27323	.26872	.26427	.25986	.25549
58	.29639	.29164	.28695	.28230	.27770	.27315	.26865	.26420	.25978	.25542
59	.29631	.29156	.28687	.28222	.27763	.27308	.26858	.26412	.25971	.25534

1^h or 1^o.

PROP. LOGARITHMS. (r.)

1^h or 1^o.

"	40'	41'	42'	43'	44'	45'	46'	47'	48'	49'
0	.25527	.25095	.24667	.24244	.23824	.23408	.22997	.22589	.22185	.21785
1	.25520	.25088	.24660	.24237	.23817	.23401	.22990	.22582	.22178	.21778
2	.25513	.25081	.24653	.24229	.23810	.23395	.22983	.22575	.22171	.21771
3	.25506	.25074	.24646	.24222	.23803	.23388	.22976	.22569	.22165	.21765
4	.25498	.25066	.24639	.24215	.23796	.23381	.22969	.22562	.22158	.21758
5	.25491	.25059	.24632	.24208	.23789	.23374	.22963	.22555	.22151	.21751
6	.25484	.25052	.24625	.24201	.23782	.23367	.22956	.22548	.22145	.21745
7	.25477	.25045	.24618	.24194	.23775	.23360	.22949	.22542	.22138	.21738
8	.25469	.25038	.24610	.24187	.23768	.23353	.22942	.22535	.22131	.21732
9	.25462	.25031	.24603	.24180	.23761	.23346	.22935	.22528	.22125	.21725
10	.25455	.25024	.24596	.24173	.23754	.23339	.22928	.22521	.22118	.21718
11	.25448	.25016	.24589	.24166	.23747	.23333	.22922	.22515	.22111	.21712
12	.25440	.25009	.24582	.24159	.23740	.23326	.22915	.22508	.22105	.21705
13	.25433	.25002	.24575	.24152	.23734	.23319	.22908	.22501	.22098	.21698
14	.25426	.24995	.24568	.24145	.23727	.23312	.22901	.22494	.22091	.21692
15	.25419	.24988	.24561	.24138	.23720	.23305	.22894	.22488	.22084	.21685
16	.25412	.24981	.24554	.24131	.23713	.23298	.22888	.22481	.22078	.21678
17	.25404	.24974	.24547	.24124	.23706	.23291	.22881	.22474	.22071	.21672
18	.25397	.24966	.24540	.24117	.23699	.23284	.22874	.22467	.22064	.21665
19	.25390	.24959	.24533	.24110	.23692	.23278	.22867	.22461	.22058	.21659
20	.25383	.24952	.24526	.24103	.23685	.23271	.22860	.22454	.22051	.21652
21	.25376	.24945	.24518	.24096	.23678	.23264	.22854	.22447	.22044	.21645
22	.25368	.24938	.24511	.24089	.23671	.23257	.22847	.22440	.22038	.21639
23	.25361	.24931	.24504	.24082	.23664	.23250	.22840	.22434	.22031	.21632
24	.25354	.24923	.24497	.24075	.23657	.23243	.22833	.22427	.22024	.21626
25	.25347	.24916	.24490	.24068	.23650	.23236	.22826	.22420	.22018	.21619
26	.25339	.24909	.24483	.24061	.23643	.23229	.22819	.22413	.22011	.21612
27	.25332	.24902	.24476	.24054	.23636	.23223	.22813	.22407	.22004	.21606
28	.25325	.24895	.24469	.24047	.23629	.23216	.22806	.22400	.21998	.21599
29	.25318	.24888	.24462	.24040	.23623	.23209	.22799	.22393	.21991	.21592
30	.25311	.24881	.24455	.24033	.23616	.23202	.22792	.22386	.21984	.21586
31	.25303	.24874	.24448	.24026	.23609	.23195	.22785	.22380	.21978	.21579
32	.25296	.24866	.24441	.24019	.23602	.23188	.22779	.22373	.21971	.21573
33	.25289	.24859	.24434	.24012	.23595	.23181	.22772	.22366	.21964	.21566
34	.25282	.24852	.24427	.24005	.23588	.23175	.22765	.22359	.21958	.21559
35	.25275	.24845	.24420	.23998	.23581	.23168	.22758	.22353	.21951	.21553
36	.25267	.24838	.24413	.23991	.23574	.23161	.22752	.22346	.21944	.21546
37	.25260	.24831	.24405	.23984	.23567	.23154	.22745	.22339	.21938	.21540
38	.25253	.24824	.24398	.23977	.23560	.23147	.22738	.22333	.21931	.21533
39	.25246	.24817	.24391	.23970	.23553	.23140	.22731	.22326	.21924	.21526
40	.25239	.24809	.24384	.23963	.23546	.23133	.22724	.22319	.21918	.21520
41	.25231	.24802	.24377	.23956	.23539	.23127	.22718	.22312	.21911	.21513
42	.25224	.24795	.24370	.23949	.23533	.23120	.22711	.22306	.21904	.21507
43	.25217	.24788	.24363	.23942	.23526	.23113	.22704	.22299	.21898	.21500
44	.25210	.24781	.24356	.23935	.23519	.23106	.22697	.22292	.21891	.21493
45	.25203	.24774	.24349	.23928	.23512	.23099	.22690	.22286	.21884	.21487
46	.25196	.24767	.24342	.23921	.23505	.23092	.22684	.22279	.21878	.21480
47	.25188	.24760	.24335	.23914	.23498	.23086	.22677	.22272	.21871	.21474
48	.25181	.24752	.24328	.23908	.23491	.23079	.22670	.22265	.21864	.21467
49	.25174	.24745	.24321	.23901	.23484	.23072	.22663	.22259	.21858	.21460
50	.25167	.24738	.24314	.23894	.23477	.23065	.22657	.22252	.21851	.21454
51	.25160	.24731	.24307	.23887	.23470	.23058	.22650	.22245	.21844	.21447
52	.25152	.24724	.24300	.23880	.23464	.23051	.22643	.22239	.21838	.21441
53	.25145	.24717	.24293	.23873	.23457	.23044	.22636	.22232	.21831	.21434
54	.25138	.24710	.24286	.23866	.23450	.23038	.22629	.22225	.21824	.21427
55	.25131	.24703	.24279	.23859	.23443	.23031	.22623	.22218	.21818	.21421
56	.25124	.24696	.24272	.23852	.23436	.23024	.22616	.22212	.21811	.21414
57	.25117	.24689	.24265	.23845	.23429	.23017	.22609	.22205	.21805	.21408
58	.25109	.24681	.24258	.23838	.23422	.23010	.22602	.22198	.21798	.21401
59	.25102	.24674	.24251	.23831	.23415	.23003	.22596	.22192	.21791	.21395

1^h or 1^o

PROP. LOGARITHMS. (r.)

 1^h or 1^o

"	50'	51'	52'	53'	54'	55'	56'	57'	58'	59'
0	.21388	.20995	.20605	.20219	.19837	.19457	.19081	.18710	.18339	.17973
1	.21381	.20988	.20599	.20213	.19830	.19451	.19075	.18702	.18333	.17966
2	.21375	.20982	.20593	.20207	.19824	.19445	.19069	.18696	.18327	.17960
3	.21368	.20975	.20586	.20200	.19818	.19439	.19063	.18690	.18321	.17954
4	.21362	.20969	.20580	.20194	.19811	.19432	.19056	.18684	.18315	.17948
5	.21355	.20962	.20573	.20187	.19805	.19426	.19050	.18678	.18308	.17942
6	.21349	.20956	.20567	.20181	.19799	.19420	.19044	.18672	.18302	.17936
7	.21342	.20949	.20560	.20175	.19792	.19413	.19038	.18665	.18296	.17930
8	.21335	.20943	.20554	.20168	.19786	.19407	.19032	.18659	.18290	.17924
9	.21329	.20936	.20547	.20162	.19780	.19401	.19025	.18653	.18284	.17918
10	.21322	.20930	.20541	.20155	.19773	.19395	.19019	.18647	.18278	.17912
11	.21316	.20923	.20534	.20149	.19767	.19388	.19013	.18641	.18272	.17906
12	.21309	.20917	.20528	.20143	.19761	.19382	.19007	.18634	.18266	.17900
13	.21303	.20910	.20522	.20136	.19754	.19376	.19000	.18628	.18259	.17894
14	.21296	.20904	.20515	.20130	.19748	.19369	.18994	.18622	.18253	.17887
15	.21289	.20897	.20509	.20123	.19742	.19363	.18988	.18616	.18247	.17881
16	.21283	.20891	.20502	.20117	.19735	.19357	.18982	.18610	.18241	.17875
17	.21276	.20884	.20496	.20111	.19729	.19351	.18976	.18604	.18235	.17869
18	.21270	.20878	.20489	.20104	.19723	.19344	.18969	.18597	.18229	.17863
19	.21263	.20871	.20483	.20098	.19716	.19338	.18963	.18591	.18223	.17857
20	.21257	.20865	.20476	.20091	.19710	.19332	.18957	.18585	.18217	.17851
21	.21250	.20858	.20470	.20085	.19704	.19325	.18951	.18579	.18210	.17845
22	.21243	.20852	.20464	.20079	.19697	.19319	.18944	.18573	.18204	.17839
23	.21237	.20845	.20457	.20072	.19691	.19313	.18938	.18567	.18198	.17833
24	.21230	.20839	.20451	.20066	.19685	.19307	.18932	.18560	.18192	.17827
25	.21224	.20832	.20444	.20060	.19678	.19300	.18926	.18554	.18186	.17821
26	.21217	.20826	.20438	.20053	.19672	.19294	.18920	.18548	.18180	.17815
27	.21211	.20819	.20431	.20047	.19666	.19288	.18913	.18542	.18174	.17809
28	.21204	.20813	.20425	.20040	.19659	.19282	.18907	.18536	.18168	.17803
29	.21198	.20806	.20418	.20034	.19653	.19275	.18901	.18530	.18162	.17797
30	.21191	.20800	.20412	.20028	.19647	.19269	.18895	.18523	.18155	.17790
31	.21184	.20793	.20406	.20021	.19640	.19263	.18888	.18517	.18149	.17784
32	.21178	.20787	.20399	.20015	.19634	.19257	.18882	.18511	.18143	.17778
33	.21171	.20780	.20393	.20009	.19628	.19250	.18876	.18505	.18137	.17772
34	.21165	.20774	.20386	.20002	.19621	.19244	.18870	.18499	.18131	.17766
35	.21158	.20767	.20380	.19996	.19615	.19238	.18864	.18493	.18125	.17760
36	.21152	.20761	.20373	.19989	.19609	.19231	.18857	.18487	.18119	.17754
37	.21145	.20754	.20367	.19983	.19602	.19225	.18851	.18480	.18113	.17748
38	.21139	.20748	.20361	.19977	.19596	.19219	.18845	.18474	.18107	.17742
39	.21132	.20741	.20354	.19970	.19590	.19213	.18839	.18468	.18100	.17736
40	.21126	.20735	.20348	.19964	.19584	.19206	.18833	.18462	.18094	.17730
41	.21119	.20728	.20341	.19958	.19577	.19200	.18826	.18456	.18088	.17724
42	.21112	.20722	.20335	.19951	.19571	.19194	.18820	.18450	.18082	.17718
43	.21106	.20715	.20328	.19945	.19565	.19188	.18814	.18443	.18076	.17712
44	.21099	.20709	.20322	.19938	.19558	.19181	.18808	.18437	.18070	.17706
45	.21093	.20702	.20316	.19932	.19552	.19175	.18802	.18431	.18064	.17700
46	.21086	.20696	.20309	.19926	.19546	.19169	.18795	.18425	.18058	.17694
47	.21080	.20690	.20303	.19919	.19539	.19163	.18789	.18419	.18052	.17688
48	.21073	.20683	.20296	.19913	.19533	.19156	.18783	.18413	.18046	.17682
49	.21067	.20677	.20290	.19907	.19527	.19150	.18777	.18407	.18040	.17676
50	.21060	.20670	.20284	.19900	.19520	.19144	.18771	.18400	.18033	.17669
51	.21054	.20664	.20277	.19894	.19514	.19138	.18764	.18394	.18027	.17663
52	.21047	.20657	.20271	.19888	.19508	.19131	.18758	.18388	.18021	.17657
53	.21041	.20651	.20264	.19881	.19502	.19125	.18752	.18382	.18015	.17651
54	.21034	.20644	.20258	.19875	.19495	.19119	.18746	.18376	.18009	.17645
55	.21028	.20638	.20251	.19869	.19489	.19113	.18740	.18370	.18003	.17639
56	.21021	.20631	.20245	.19862	.19483	.19106	.18733	.18364	.17997	.17633
57	.21015	.20625	.20239	.19856	.19476	.19100	.18727	.18357	.17991	.17627
58	.21008	.20618	.20232	.19849	.19470	.19094	.18721	.18351	.17985	.17621
59	.21001	.20612	.20226	.19843	.19464	.19088	.18715	.18345	.17979	.17615

2^h or 2^o.

PROP. LOGARITHMS. (r.)

2^h or 2^o.

"	0'	1'	2'	3'	4'	5'	6'	7'	8'	9'
0	.17609	.17249	.16891	.16537	.16185	.15836	.15490	.15147	.14806	.14468
1	.17603	.17243	.16885	.16531	.16179	.15830	.15484	.15141	.14801	.14463
2	.17597	.17237	.16879	.16525	.16173	.15825	.15479	.15135	.14795	.14457
3	.17591	.17231	.16873	.16519	.16168	.15819	.15473	.15130	.14789	.14451
4	.17585	.17225	.16868	.16513	.16162	.15813	.15467	.15124	.14784	.14446
5	.17579	.17219	.16862	.16507	.16156	.15807	.15461	.15118	.14778	.14440
6	.17573	.17213	.16856	.16501	.16150	.15802	.15456	.15113	.14772	.14435
7	.17567	.17207	.16850	.16496	.16144	.15796	.15450	.15107	.14767	.14429
8	.17561	.17201	.16844	.16490	.16138	.15790	.15444	.15101	.14761	.14423
9	.17555	.17195	.16838	.16484	.16133	.15784	.15439	.15096	.14755	.14418
10	.17549	.17189	.16832	.16478	.16127	.15778	.15433	.15090	.14750	.14412
11	.17543	.17183	.16826	.16472	.16121	.15773	.15427	.15084	.14744	.14407
12	.17537	.17177	.16820	.16466	.16115	.15767	.15421	.15079	.14738	.14401
13	.17531	.17171	.16814	.16460	.16109	.15761	.15416	.15073	.14733	.14395
14	.17525	.17165	.16808	.16454	.16103	.15755	.15410	.15067	.14727	.14390
15	.17519	.17159	.16802	.16449	.16098	.15749	.15404	.15061	.14722	.14384
16	.17513	.17153	.16796	.16443	.16092	.15744	.15398	.15056	.14716	.14379
17	.17507	.17147	.16791	.16437	.16086	.15738	.15393	.15050	.14710	.14373
18	.17501	.17141	.16785	.16431	.16080	.15732	.15387	.15044	.14705	.14367
19	.17495	.17135	.16779	.16425	.16074	.15726	.15381	.15039	.14699	.14362
20	.17489	.17129	.16773	.16419	.16068	.15721	.15375	.15033	.14693	.14356
21	.17483	.17123	.16767	.16413	.16063	.15715	.15370	.15027	.14688	.14351
22	.17477	.17117	.16761	.16407	.16057	.15709	.15364	.15022	.14682	.14345
23	.17471	.17111	.16755	.16402	.16051	.15703	.15358	.15016	.14676	.14339
24	.17465	.17105	.16749	.16396	.16045	.15697	.15353	.15010	.14671	.14334
25	.17460	.17099	.16743	.16390	.16039	.15692	.15347	.15005	.14665	.14328
26	.17453	.17093	.16737	.16384	.16034	.15686	.15341	.14999	.14659	.14323
27	.17447	.17087	.16731	.16378	.16028	.15680	.15335	.14993	.14654	.14317
28	.17441	.17082	.16725	.16372	.16022	.15674	.15330	.14988	.14648	.14311
29	.17435	.17076	.16720	.16366	.16016	.15669	.15324	.14982	.14643	.14306
30	.17429	.17070	.16714	.16361	.16010	.15663	.15318	.14976	.14637	.14300
31	.17423	.17064	.16708	.16354	.16005	.15657	.15312	.14971	.14631	.14295
32	.17417	.17058	.16702	.16349	.15999	.15651	.15307	.14965	.14626	.14289
33	.17411	.17052	.16696	.16343	.15993	.15646	.15301	.14959	.14620	.14284
34	.17405	.17046	.16690	.16337	.15987	.15640	.15295	.14954	.14614	.14278
35	.17399	.17040	.16684	.16331	.15981	.15634	.15290	.14948	.14609	.14272
36	.17393	.17034	.16678	.16325	.15975	.15628	.15284	.14942	.14603	.14267
37	.17387	.17028	.16672	.16320	.15970	.15623	.15278	.14937	.14598	.14261
38	.17381	.17022	.16666	.16314	.15964	.15617	.15272	.14931	.14592	.14256
39	.17375	.17016	.16660	.16308	.15958	.15611	.15267	.14925	.14586	.14250
40	.17369	.17010	.16655	.16302	.15952	.15605	.15261	.14919	.14581	.14244
41	.17363	.17004	.16649	.16296	.15946	.15599	.15255	.14914	.14575	.14239
42	.17357	.16998	.16643	.16290	.15941	.15594	.15250	.14908	.14569	.14233
43	.17351	.16992	.16637	.16284	.15935	.15588	.15244	.14902	.14564	.14228
44	.17345	.16986	.16631	.16279	.15929	.15582	.15238	.14897	.14558	.14222
45	.17339	.16980	.16625	.16273	.15923	.15576	.15232	.14891	.14553	.14217
46	.17333	.16974	.16619	.16267	.15917	.15571	.15227	.14886	.14547	.14211
47	.17327	.16968	.16613	.16261	.15912	.15565	.15221	.14880	.14541	.14205
48	.17321	.16963	.16607	.16255	.15906	.15559	.15215	.14874	.14536	.14200
49	.17315	.16957	.16602	.16249	.15900	.15553	.15210	.14869	.14530	.14194
50	.17309	.16951	.16596	.16243	.15894	.15548	.15204	.14863	.14524	.14189
51	.17303	.16945	.16590	.16238	.15888	.15542	.15198	.14857	.14519	.14183
52	.17297	.16939	.16584	.16232	.15883	.15536	.15192	.14852	.14513	.14177
53	.17291	.16933	.16578	.16226	.15877	.15530	.15187	.14846	.14508	.14172
54	.17285	.16927	.16572	.16220	.15871	.15525	.15181	.14840	.14502	.14166
55	.17279	.16921	.16566	.16214	.15865	.15519	.15175	.14835	.14496	.14161
56	.17273	.16915	.16560	.16208	.15859	.15513	.15170	.14829	.14491	.14155
57	.17267	.16909	.16554	.16203	.15854	.15507	.15164	.14823	.14485	.14150
58	.17261	.16903	.16549	.16197	.15848	.15502	.15158	.14818	.14480	.14144
59	.17255	.16897	.16543	.16191	.15842	.15496	.15153	.14812	.14474	.14138

2^h or 2^o.

PROP. LOGARITHMS. (r.)

2^h or 2^o.

"	10'	11	12'	13'	14'	15'	16'	17'	18'	19'
0	.14133	.13800	.13470	.13142	.12817	.12494	.12173	.11855	.11539	.11226
1	.14127	.13795	.13464	.13137	.12811	.12489	.12168	.11850	.11534	.11221
2	.14122	.13789	.13459	.13131	.12806	.12483	.12163	.11845	.11529	.11215
3	.14116	.13784	.13453	.13126	.12801	.12478	.12157	.11839	.11524	.11210
4	.14111	.13778	.13448	.13120	.12795	.12472	.12152	.11834	.11518	.11205
5	.14105	.13773	.13442	.13115	.12790	.12467	.12147	.11829	.11513	.11200
6	.14100	.13767	.13437	.13109	.12784	.12462	.12141	.11824	.11508	.11195
7	.14094	.13761	.13431	.13104	.12779	.12456	.12136	.11818	.11503	.11189
8	.14088	.13756	.13426	.13099	.12774	.12451	.12131	.11813	.11497	.11184
9	.14083	.13750	.13421	.13093	.12768	.12446	.12125	.11808	.11492	.11179
10	.14077	.13745	.13415	.13088	.12763	.12440	.12120	.11802	.11487	.11174
11	.14072	.13739	.13410	.13082	.12757	.12435	.12115	.11797	.11482	.11169
12	.14066	.13734	.13404	.13077	.12752	.12430	.12110	.11792	.11476	.11163
13	.14061	.13728	.13399	.13071	.12747	.12424	.12104	.11787	.11471	.11158
14	.14055	.13723	.13393	.13066	.12741	.12419	.12099	.11781	.11466	.11153
15	.14049	.13717	.13388	.13061	.12736	.12414	.12094	.11776	.11461	.11148
16	.14044	.13712	.13382	.13055	.12730	.12408	.12088	.11771	.11456	.11143
17	.14038	.13706	.13377	.13050	.12725	.12403	.12083	.11765	.11450	.11137
18	.14033	.13701	.13371	.13044	.12720	.12397	.12078	.11760	.11445	.11132
19	.14027	.13695	.13366	.13039	.12714	.12392	.12072	.11755	.11440	.11127
20	.14022	.13690	.13360	.13033	.12709	.12387	.12067	.11750	.11435	.11122
21	.14016	.13684	.13355	.13028	.12703	.12381	.12062	.11744	.11429	.11117
22	.14011	.13679	.13349	.13023	.12698	.12376	.12056	.11739	.11424	.11111
23	.14005	.13673	.13344	.13017	.12693	.12371	.12051	.11734	.11419	.11106
24	.13999	.13668	.13338	.13012	.12687	.12365	.12046	.11729	.11414	.11101
25	.13994	.13662	.13333	.13006	.12682	.12360	.12041	.11723	.11408	.11096
26	.13988	.13657	.13328	.13001	.12677	.12355	.12035	.11718	.11403	.11091
27	.13983	.13651	.13322	.12995	.12671	.12349	.12030	.11713	.11398	.11086
28	.13977	.13646	.13317	.12990	.12666	.12344	.12025	.11708	.11393	.11080
29	.13972	.13640	.13311	.12985	.12660	.12339	.12019	.11702	.11387	.11075
30	.13966	.13635	.13306	.12979	.12655	.12333	.12014	.11697	.11382	.11070
31	.13961	.13629	.13300	.12974	.12650	.12328	.12009	.11692	.11377	.11065
32	.13955	.13624	.13295	.12968	.12644	.12323	.12003	.11686	.11372	.11059
33	.13949	.13618	.13289	.12963	.12639	.12317	.11998	.11681	.11367	.11054
34	.13944	.13613	.13284	.12957	.12634	.12312	.11993	.11676	.11361	.11049
35	.13938	.13607	.13278	.12952	.12628	.12307	.11987	.11671	.11356	.11044
36	.13933	.13602	.13273	.12947	.12623	.12301	.11982	.11665	.11351	.11039
37	.13927	.13596	.13267	.12941	.12617	.12296	.11977	.11660	.11346	.11034
38	.13922	.13591	.13262	.12936	.12612	.12291	.11972	.11655	.11340	.11028
39	.13916	.13585	.13257	.12930	.12607	.12285	.11965	.11650	.11335	.11023
40	.13911	.13580	.13251	.12925	.12601	.12280	.11961	.11644	.11330	.11018
41	.13905	.13574	.13246	.12920	.12596	.12275	.11956	.11639	.11325	.11013
42	.13900	.13569	.13240	.12914	.12590	.12269	.11950	.11634	.11320	.11008
43	.13894	.13563	.13235	.12909	.12585	.12264	.11945	.11629	.11314	.11002
44	.13889	.13558	.13229	.12903	.12580	.12259	.11940	.11623	.11309	.10997
45	.13883	.13552	.13224	.12898	.12574	.12253	.11935	.11618	.11304	.10992
46	.13878	.13547	.13218	.12892	.12569	.12248	.11929	.11613	.11299	.10987
47	.13872	.13541	.13213	.12887	.12564	.12243	.11924	.11608	.11294	.10982
48	.13866	.13536	.13207	.12882	.12558	.12237	.11919	.11602	.11288	.10977
49	.13861	.13530	.13202	.12876	.12553	.12232	.11913	.11597	.11283	.10971
50	.13855	.13525	.13197	.12871	.12548	.12227	.11908	.11592	.11278	.10966
51	.13850	.13519	.13191	.12865	.12542	.12221	.11903	.11587	.11273	.10961
52	.13844	.13514	.13186	.12860	.12537	.12216	.11897	.11581	.11267	.10956
53	.13839	.13508	.13180	.12855	.12531	.12211	.11892	.11576	.11262	.10951
54	.13833	.13503	.13175	.12849	.12526	.12205	.11887	.11571	.11257	.10945
55	.13828	.13497	.13169	.12844	.12521	.12200	.11882	.11566	.11252	.10940
56	.13822	.13492	.13164	.12838	.12515	.12195	.11876	.11560	.11247	.10935
57	.13817	.13486	.13158	.12833	.12510	.12189	.11871	.11555	.11241	.10930
58	.13811	.13481	.13153	.12828	.12505	.12184	.11866	.11550	.11236	.10925
59	.13806	.13475	.13148	.12822	.12499	.12179	.11860	.11545	.11231	.10920

2^h or 2^o.

PROP. LOGARITHMS. (r.)

2^h or 2^o.

#	20'	21'	22'	23'	24'	25'	26'	27'	28'	29'
0	.10914	.10605	.10298	.09994	.09691	.09390	.09092	.08796	.08501	.08209
1	.10909	.10600	.10293	.09989	.09686	.09385	.09087	.08791	.08496	.08204
2	.10904	.10595	.10288	.09984	.09681	.09380	.09082	.08786	.08491	.08199
3	.10899	.10590	.10283	.09978	.09676	.09375	.09077	.08781	.08486	.08194
4	.10894	.10585	.10278	.09973	.09671	.09370	.09072	.08776	.08482	.08189
5	.10889	.10580	.10273	.09968	.09666	.09365	.09067	.08771	.08477	.08184
6	.10883	.10575	.10268	.09963	.09661	.09360	.09062	.08766	.08472	.08179
7	.10878	.10569	.10263	.09958	.09656	.09356	.09057	.08761	.08467	.08175
8	.10873	.10564	.10258	.09953	.09651	.09351	.09052	.08756	.08462	.08170
9	.10868	.10559	.10253	.09948	.09646	.09346	.09047	.08751	.08457	.08165
10	.10863	.10554	.10247	.09943	.09641	.09341	.09042	.08746	.08452	.08160
11	.10858	.10549	.10242	.09938	.09636	.09336	.09037	.08741	.08447	.08155
12	.10852	.10544	.10237	.09933	.09631	.09331	.09033	.08736	.08442	.08150
13	.10847	.10539	.10232	.09928	.09626	.09326	.09028	.08732	.08438	.08146
14	.10842	.10534	.10227	.09923	.09621	.09321	.09023	.08727	.08433	.08141
15	.10837	.10528	.10222	.09918	.09616	.09316	.09018	.08722	.08428	.08136
16	.10832	.10523	.10217	.09913	.09611	.09311	.09013	.08717	.08423	.08131
17	.10827	.10518	.10212	.09908	.09606	.09306	.09008	.08712	.08418	.08126
18	.10821	.10513	.10207	.09903	.09601	.09301	.09003	.08707	.08413	.08121
19	.10816	.10508	.10202	.09898	.09596	.09296	.08998	.08702	.08408	.08116
20	.10811	.10503	.10197	.09893	.09591	.09291	.08993	.08697	.08403	.08112
21	.10806	.10498	.10192	.09887	.09586	.09286	.08988	.08692	.08398	.08107
22	.10801	.10493	.10186	.09882	.09581	.09281	.08983	.08687	.08394	.08102
23	.10796	.10487	.10181	.09877	.09576	.09276	.08978	.08682	.08389	.08097
24	.10791	.10482	.10176	.09872	.09571	.09271	.08973	.08678	.08384	.08092
25	.10785	.10477	.10171	.09867	.09566	.09266	.08968	.08673	.08379	.08087
26	.10780	.10472	.10166	.09862	.09561	.09261	.08963	.08668	.08374	.08083
27	.10775	.10467	.10161	.09857	.09556	.09256	.08958	.08663	.08369	.08078
28	.10770	.10462	.10156	.09852	.09550	.09251	.08953	.08658	.08364	.08073
29	.10765	.10457	.10151	.09847	.09545	.09246	.08948	.08653	.08359	.08068
30	.10760	.10452	.10146	.09842	.09540	.09241	.08943	.08648	.08355	.08063
31	.10754	.10447	.10141	.09837	.09535	.09236	.08939	.08643	.08350	.08058
32	.10749	.10441	.10136	.09832	.09530	.09231	.08934	.08638	.08345	.08053
33	.10744	.10436	.10131	.09827	.09525	.09226	.08929	.08633	.08340	.08049
34	.10739	.10431	.10126	.09822	.09520	.09221	.08924	.08628	.08335	.08044
35	.10734	.10426	.10120	.09817	.09515	.09216	.08919	.08624	.08330	.08039
36	.10729	.10421	.10115	.09812	.09510	.09211	.08914	.08619	.08325	.08034
37	.10724	.10416	.10110	.09807	.09505	.09206	.08909	.08614	.08320	.08029
38	.10718	.10411	.10105	.09802	.09500	.09201	.08904	.08609	.08316	.08024
39	.10713	.10406	.10100	.09797	.09495	.09196	.08899	.08604	.08311	.08020
40	.10708	.10400	.10095	.09792	.09490	.09191	.08894	.08599	.08306	.08015
41	.10703	.10395	.10090	.09787	.09485	.09186	.08889	.08594	.08301	.08010
42	.10698	.10390	.10085	.09782	.09480	.09181	.08884	.08589	.08296	.08005
43	.10693	.10385	.10080	.09777	.09475	.09176	.08879	.08584	.08291	.08000
44	.10688	.10380	.10075	.09772	.09470	.09171	.08874	.08579	.08286	.07995
45	.10682	.10375	.10070	.09766	.09465	.09166	.08869	.08575	.08282	.07991
46	.10677	.10370	.10065	.09761	.09460	.09161	.08865	.08570	.08277	.07986
47	.10672	.10365	.10059	.09756	.09455	.09156	.08860	.08565	.08272	.07981
48	.10667	.10360	.10054	.09751	.09450	.09151	.08855	.08560	.08267	.07976
49	.10662	.10355	.10049	.09746	.09445	.09147	.08850	.08555	.08262	.07971
50	.10657	.10349	.10044	.09741	.09440	.09142	.08845	.08550	.08257	.07966
51	.10652	.10344	.10039	.09736	.09435	.09137	.08840	.08545	.08252	.07962
52	.10646	.10339	.10034	.09731	.09430	.09132	.08835	.08540	.08248	.07957
53	.10641	.10334	.10029	.09726	.09425	.09127	.08830	.08535	.08243	.07952
54	.10636	.10329	.10024	.09721	.09420	.09122	.08825	.08530	.08238	.07947
55	.10631	.10324	.10019	.09716	.09415	.09117	.08820	.08526	.08233	.07942
56	.10626	.10319	.10014	.09711	.09410	.09112	.08815	.08521	.08228	.07937
57	.10621	.10314	.10009	.09706	.09405	.09107	.08810	.08516	.08223	.07933
58	.10616	.10309	.10004	.09701	.09400	.09102	.08805	.08511	.08218	.07928
59	.10610	.10304	.00999	.09696	.09395	.09097	.08800	.08506	.08213	.07923

2^h or 2°

PROP. LOGARITHMS. (r.)

 2^h or 2°

h	30'	31'	32'	33'	34'	35'	36'	37'	38'	39'
0	.07918	.07630	.07343	.07058	.06775	.06494	.06215	.05937	.05662	.05388
1	.07913	.07625	.07338	.07053	.06770	.06489	.06210	.05933	.05657	.05383
2	.07908	.07620	.07333	.07049	.06766	.06485	.06206	.05928	.05652	.05378
3	.07904	.07615	.07329	.07044	.06761	.06480	.06201	.05923	.05648	.05374
4	.07899	.07610	.07324	.07039	.06756	.06475	.06196	.05919	.05643	.05369
5	.07894	.07606	.07319	.07034	.06752	.06471	.06192	.05914	.05639	.05365
6	.07889	.07601	.07314	.07030	.06747	.06466	.06187	.05910	.05634	.05360
7	.07884	.07596	.07310	.07025	.06742	.06461	.06182	.05905	.05629	.05356
8	.07880	.07591	.07305	.07020	.06738	.06457	.06178	.05900	.05625	.05351
9	.07875	.07586	.07300	.07016	.06733	.06452	.06173	.05896	.05620	.05347
10	.07870	.07582	.07295	.07011	.06728	.06447	.06168	.05891	.05616	.05342
11	.07865	.07577	.07291	.07006	.06724	.06443	.06164	.05887	.05611	.05337
12	.07860	.07572	.07286	.07001	.06719	.06438	.06159	.05882	.05607	.05333
13	.07855	.07567	.07281	.06997	.06714	.06433	.06155	.05877	.05602	.05328
14	.07851	.07562	.07276	.06992	.06709	.06429	.06150	.05873	.05597	.05324
15	.07846	.07558	.07272	.06987	.06705	.06424	.06145	.05868	.05593	.05319
16	.07841	.07553	.07267	.06982	.06700	.06419	.06141	.05864	.05588	.05315
17	.07836	.07548	.07262	.06978	.06695	.06415	.06136	.05859	.05584	.05310
18	.07831	.07543	.07257	.06973	.06691	.06410	.06131	.05854	.05579	.05306
19	.07827	.07539	.07253	.06968	.06686	.06405	.06127	.05850	.05575	.05301
20	.07822	.07534	.07248	.06964	.06681	.06401	.06122	.05845	.05570	.05297
21	.07817	.07529	.07243	.06959	.06677	.06396	.06117	.05841	.05566	.05292
22	.07812	.07524	.07238	.06954	.06672	.06391	.06113	.05836	.05561	.05288
23	.07807	.07519	.07234	.06949	.06667	.06387	.06108	.05831	.05556	.05283
24	.07802	.07515	.07229	.06945	.06663	.06382	.06104	.05827	.05552	.05278
25	.07798	.07510	.07224	.06940	.06658	.06377	.06099	.05822	.05547	.05274
26	.07793	.07505	.07219	.06935	.06653	.06373	.06094	.05818	.05543	.05269
27	.07788	.07500	.07215	.06931	.06648	.06368	.06090	.05813	.05538	.05265
28	.07783	.07496	.07210	.06926	.06644	.06364	.06085	.05808	.05533	.05260
29	.07778	.07491	.07205	.06921	.06639	.06359	.06080	.05804	.05529	.05256
30	.07774	.07486	.07200	.06916	.06634	.06354	.06076	.05799	.05524	.05251
31	.07769	.07481	.07196	.06912	.06630	.06350	.06071	.05795	.05520	.05247
32	.07764	.07476	.07191	.06907	.06625	.06345	.06067	.05790	.05515	.05242
33	.07759	.07472	.07186	.06902	.06620	.06340	.06062	.05785	.05511	.05238
34	.07754	.07467	.07181	.06898	.06616	.06336	.06057	.05781	.05506	.05233
35	.07750	.07462	.07177	.06893	.06611	.06331	.06053	.05776	.05501	.05229
36	.07745	.07457	.07172	.06888	.06606	.06326	.06048	.05772	.05497	.05224
37	.07740	.07453	.07167	.06883	.06602	.06322	.06043	.05767	.05492	.05219
38	.07735	.07448	.07162	.06879	.06597	.06317	.06039	.05762	.05488	.05215
39	.07730	.07443	.07158	.06874	.06592	.06312	.06034	.05758	.05483	.05210
40	.07726	.07438	.07153	.06869	.06588	.06308	.06030	.05753	.05479	.05206
41	.07721	.07433	.07148	.06865	.06583	.06303	.06025	.05749	.05474	.05201
42	.07716	.07429	.07143	.06860	.06578	.06298	.06020	.05744	.05470	.05197
43	.07711	.07424	.07139	.06855	.06574	.06294	.06016	.05739	.05465	.05192
44	.07706	.07419	.07134	.06850	.06569	.06289	.06011	.05735	.05460	.05188
45	.07702	.07414	.07129	.06846	.06564	.06284	.06006	.05730	.05456	.05183
46	.07697	.07410	.07124	.06841	.06559	.06280	.06002	.05726	.05451	.05179
47	.07692	.07405	.07120	.06836	.06555	.06275	.05997	.05721	.05447	.05174
48	.07687	.07400	.07115	.06832	.06550	.06271	.05993	.05717	.05442	.05170
49	.07682	.07395	.07110	.06827	.06545	.06266	.05988	.05712	.05438	.05165
50	.07678	.07391	.07105	.06822	.06541	.06261	.05983	.05707	.05433	.05161
51	.07673	.07386	.07101	.06817	.06536	.06257	.05979	.05703	.05429	.05156
52	.07668	.07381	.07096	.06813	.06531	.06252	.05974	.05698	.05424	.05151
53	.07663	.07376	.07091	.06808	.06527	.06247	.05970	.05694	.05419	.05147
54	.07658	.07371	.07087	.06803	.06522	.06243	.05965	.05689	.05415	.05142
55	.07654	.07367	.07082	.06799	.06517	.06238	.05960	.05684	.05410	.05138
56	.07649	.07362	.07077	.06794	.06513	.06233	.05956	.05680	.05406	.05133
57	.07644	.07357	.07072	.06789	.06508	.06229	.05951	.05675	.05401	.05129
58	.07639	.07352	.07068	.06784	.06503	.06224	.05947	.05671	.05397	.05124
59	.07634	.07348	.07063	.06780	.06499	.06219	.05942	.05666	.05392	.05120

2^a or 2^o.

PROP. LOGARITHMS. (r.)

2^a or 2^o.

"	40'	41'	42'	43'	44	45'	46'	47'	48'	49'
0	.05115	.04845	.04576	.04308	.04043	.03779	.03516	.03256	.02996	.02739
1	.05111	.04840	.04571	.04304	.04038	.03774	.03512	.03251	.02992	.02734
2	.05106	.04836	.04567	.04300	.04034	.03770	.03508	.03247	.02988	.02730
3	.05102	.04831	.04562	.04295	.04030	.03766	.03503	.03243	.02983	.02726
4	.05097	.04827	.04558	.04291	.04025	.03761	.03499	.03238	.02979	.02721
5	.05093	.04822	.04553	.04286	.04021	.03757	.03495	.03234	.02975	.02717
6	.05088	.04818	.04549	.04282	.04016	.03753	.03490	.03230	.02970	.02713
7	.05084	.04813	.04544	.04277	.04012	.03748	.03486	.03225	.02966	.02709
8	.05079	.04809	.04540	.04273	.04008	.03744	.03482	.03221	.02962	.02704
9	.05075	.04804	.04536	.04269	.04003	.03739	.03477	.03217	.02958	.02700
10	.05070	.04800	.04531	.04264	.03999	.03735	.03473	.03212	.02953	.02696
11	.05066	.04795	.04527	.04260	.03994	.03731	.03469	.03208	.02949	.02691
12	.05061	.04791	.04522	.04255	.03990	.03726	.03464	.03204	.02945	.02687
13	.05056	.04786	.04518	.04251	.03986	.03722	.03460	.03199	.02940	.02683
14	.05052	.04782	.04513	.04246	.03981	.03717	.03455	.03195	.02936	.02679
15	.05047	.04777	.04509	.04242	.03977	.03713	.03451	.03191	.02932	.02674
16	.05043	.04773	.04504	.04237	.03972	.03709	.03447	.03186	.02927	.02670
17	.05038	.04768	.04500	.04233	.03968	.03704	.03442	.03182	.02923	.02666
18	.05034	.04764	.04495	.04229	.03963	.03700	.03438	.03178	.02919	.02662
19	.05029	.04759	.04491	.04224	.03959	.03696	.03434	.03173	.02915	.02657
20	.05025	.04755	.04486	.04220	.03955	.03691	.03429	.03169	.02910	.02653
21	.05020	.04750	.04482	.04215	.03950	.03687	.03425	.03165	.02906	.02649
22	.05016	.04746	.04478	.04211	.03946	.03682	.03421	.03160	.02902	.02644
23	.05011	.04741	.04473	.04206	.03941	.03678	.03416	.03156	.02897	.02640
24	.05007	.04737	.04469	.04202	.03937	.03674	.03412	.03152	.02893	.02636
25	.05002	.04732	.04464	.04198	.03933	.03669	.03408	.03147	.02889	.02632
26	.04998	.04728	.04460	.04193	.03928	.03665	.03403	.03143	.02884	.02627
27	.04993	.04723	.04455	.04189	.03924	.03661	.03399	.03139	.02880	.02623
28	.04989	.04719	.04451	.04184	.03919	.03656	.03395	.03134	.02876	.02619
29	.04984	.04714	.04446	.04180	.03915	.03652	.03390	.03130	.02872	.02615
30	.04980	.04710	.04442	.04175	.03911	.03647	.03386	.03126	.02867	.02610
31	.04975	.04706	.04437	.04171	.03906	.03643	.03381	.03121	.02863	.02606
32	.04971	.04701	.04433	.04167	.03902	.03639	.03377	.03117	.02859	.02602
33	.04966	.04697	.04429	.04162	.03897	.03634	.03373	.03113	.02854	.02598
34	.04962	.04692	.04424	.04158	.03893	.03630	.03368	.03108	.02850	.02593
35	.04957	.04688	.04420	.04153	.03889	.03626	.03364	.03104	.02846	.02589
36	.04953	.04683	.04415	.04149	.03884	.03621	.03360	.03100	.02841	.02585
37	.04948	.04679	.04411	.04144	.03880	.03617	.03355	.03096	.02837	.02580
38	.04944	.04674	.04406	.04140	.03875	.03612	.03351	.03091	.02833	.02576
39	.04939	.04670	.04402	.04136	.03871	.03608	.03347	.03087	.02829	.02572
40	.04935	.04665	.04397	.04131	.03867	.03604	.03342	.03083	.02824	.02568
41	.04930	.04661	.04393	.04127	.03862	.03599	.03338	.03078	.02820	.02563
42	.04926	.04656	.04388	.04122	.03858	.03595	.03334	.03074	.02816	.02559
43	.04921	.04652	.04384	.04118	.03853	.03591	.03329	.03070	.02811	.02555
44	.04917	.04647	.04380	.04114	.03849	.03586	.03325	.03065	.02807	.02551
45	.04912	.04643	.04375	.04109	.03845	.03582	.03321	.03061	.02803	.02546
46	.04908	.04638	.04371	.04105	.03840	.03578	.03316	.03057	.02799	.02542
47	.04903	.04634	.04366	.04100	.03836	.03573	.03312	.03052	.02794	.02538
48	.04899	.04629	.04362	.04096	.03832	.03569	.03308	.03048	.02790	.02533
49	.04894	.04625	.04357	.04091	.03827	.03564	.03303	.03044	.02786	.02529
50	.04890	.04620	.04353	.04087	.03823	.03560	.03299	.03039	.02781	.02525
51	.04885	.04616	.04348	.04083	.03818	.03556	.03295	.03035	.02777	.02521
52	.04881	.04612	.04344	.04078	.03814	.03551	.03290	.03031	.02773	.02516
53	.04876	.04607	.04340	.04074	.03810	.03547	.03286	.03026	.02769	.02512
54	.04872	.04603	.04335	.04069	.03805	.03543	.03282	.03022	.02764	.02508
55	.04867	.04598	.04331	.04065	.03801	.03538	.03277	.03018	.02760	.02504
56	.04863	.04594	.04326	.04061	.03796	.03534	.03273	.03014	.02756	.02499
57	.04858	.04589	.04322	.04056	.03792	.03530	.03269	.03009	.02751	.02495
58	.04854	.04585	.04317	.04052	.03788	.03525	.03264	.03005	.02747	.02491
59	.04849	.04580	.04313	.04047	.03783	.03521	.03260	.03001	.02743	.02487

2^h or 2^o.

PROP. LOGARITHMS. (r.)

2^h or 2^o.

"	50'	51'	52'	53'	54'	55'	56'	57'	58'	59'
0	.02482	.02228	.01974	.01723	.01472	.01223	.00976	.00730	.00485	.00242
1	.02478	.02223	.01970	.01718	.01468	.01219	.00972	.00726	.00481	.00238
2	.02474	.02219	.01966	.01714	.01464	.01215	.00968	.00722	.00477	.00234
3	.02470	.02215	.01962	.01710	.01460	.01211	.00964	.00718	.00473	.00230
4	.02465	.02211	.01958	.01706	.01456	.01207	.00960	.00714	.00469	.00226
5	.02461	.02206	.01953	.01702	.01452	.01203	.00955	.00709	.00465	.00222
6	.02457	.02202	.01949	.01698	.01447	.01199	.00951	.00705	.00461	.00218
7	.02453	.02198	.01945	.01693	.01443	.01195	.00947	.00701	.00457	.00214
8	.02448	.02194	.01941	.01689	.01439	.01190	.00943	.00697	.00453	.00210
9	.02444	.02190	.01937	.01685	.01435	.01186	.00939	.00693	.00449	.00206
10	.02440	.02185	.01932	.01681	.01431	.01182	.00935	.00689	.00445	.00202
11	.02436	.02181	.01928	.01677	.01427	.01178	.00931	.00685	.00441	.00197
12	.02431	.02177	.01924	.01672	.01422	.01174	.00927	.00681	.00436	.00193
13	.02427	.02173	.01920	.01668	.01418	.01170	.00923	.00677	.00432	.00189
14	.02423	.02168	.01916	.01664	.01414	.01166	.00918	.00673	.00428	.00185
15	.02419	.02164	.01911	.01660	.01410	.01161	.00914	.00669	.00424	.00181
16	.02414	.02160	.01907	.01656	.01406	.01157	.00910	.00665	.00420	.00177
17	.02410	.02156	.01903	.01652	.01402	.01153	.00906	.00660	.00416	.00173
18	.02406	.02152	.01899	.01647	.01398	.01149	.00902	.00656	.00412	.00169
19	.02402	.02147	.01895	.01643	.01393	.01145	.00898	.00652	.00408	.00165
20	.02397	.02143	.01890	.01639	.01389	.01141	.00894	.00648	.00404	.00161
21	.02393	.02139	.01886	.01635	.01385	.01137	.00890	.00644	.00400	.00157
22	.02389	.02135	.01882	.01631	.01381	.01133	.00886	.00640	.00396	.00153
23	.02385	.02130	.01878	.01627	.01377	.01128	.00882	.00636	.00392	.00149
24	.02380	.02126	.01874	.01622	.01373	.01124	.00877	.00632	.00388	.00145
25	.02376	.02122	.01869	.01618	.01368	.01120	.00873	.00628	.00384	.00141
26	.02372	.02118	.01865	.01614	.01364	.01116	.00869	.00624	.00380	.00137
27	.02368	.02114	.01861	.01610	.01360	.01112	.00865	.00620	.00376	.00133
28	.02363	.02109	.01857	.01606	.01356	.01108	.00861	.00616	.00372	.00129
29	.02359	.02105	.01853	.01601	.01352	.01104	.00857	.00611	.00367	.00125
30	.02355	.02101	.01848	.01597	.01348	.01100	.00853	.00607	.00363	.00121
31	.02351	.02097	.01844	.01593	.01344	.01095	.00849	.00603	.00359	.00117
32	.02346	.02092	.01840	.01589	.01339	.01091	.00845	.00599	.00355	.00113
33	.02342	.02088	.01836	.01585	.01335	.01087	.00840	.00595	.00351	.00109
34	.02338	.02084	.01832	.01581	.01331	.01083	.00836	.00591	.00347	.00105
35	.02334	.02080	.01827	.01576	.01327	.01079	.00832	.00587	.00343	.00101
36	.02329	.02076	.01823	.01572	.01323	.01075	.00828	.00583	.00339	.00097
37	.02325	.02071	.01819	.01568	.01319	.01071	.00824	.00579	.00335	.00093
38	.02321	.02067	.01815	.01564	.01315	.01067	.00820	.00575	.00331	.00089
39	.02317	.02063	.01811	.01560	.01310	.01062	.00816	.00571	.00327	.00085
40	.02312	.02059	.01806	.01556	.01306	.01058	.00812	.00567	.00323	.00080
41	.02308	.02054	.01802	.01551	.01302	.01054	.00808	.00563	.00319	.00076
42	.02304	.02050	.01798	.01547	.01298	.01050	.00804	.00559	.00315	.00072
43	.02300	.02046	.01794	.01543	.01294	.01046	.00799	.00554	.00311	.00068
44	.02295	.02042	.01790	.01539	.01290	.01042	.00795	.00550	.00307	.00064
45	.02291	.02038	.01785	.01535	.01286	.01038	.00791	.00546	.00303	.00060
46	.02287	.02033	.01781	.01531	.01281	.01034	.00787	.00542	.00299	.00056
47	.02283	.02029	.01777	.01526	.01277	.01029	.00783	.00538	.00295	.00052
48	.02278	.02025	.01773	.01522	.01273	.01025	.00779	.00534	.00290	.00048
49	.02274	.02021	.01769	.01518	.01269	.01021	.00775	.00530	.00286	.00044
50	.02270	.02017	.01764	.01514	.01265	.01017	.00771	.00526	.00282	.00040
51	.02266	.02012	.01760	.01510	.01261	.01013	.00767	.00522	.00278	.00036
52	.02262	.02008	.01756	.01506	.01257	.01009	.00763	.00518	.00274	.00032
53	.02257	.02004	.01752	.01501	.01252	.01005	.00759	.00514	.00270	.00028
54	.02253	.02000	.01748	.01497	.01248	.01001	.00754	.00510	.00266	.00024
55	.02249	.01995	.01744	.01493	.01244	.00997	.00750	.00506	.00262	.00020
56	.02245	.01991	.01739	.01489	.01240	.00992	.00746	.00502	.00258	.00016
57	.02240	.01987	.01735	.01485	.01236	.00988	.00742	.00497	.00254	.00012
58	.02236	.01983	.01731	.01481	.01232	.00984	.00738	.00493	.00250	.00008
59	.02232	.01979	.01727	.01476	.01228	.00980	.00734	.00489	.00246	.00004

LOG. SINE TO SECONDS. (s.)

"	0° 0'	0° 1'	0° 2'	0° 3'	0° 4'	0° 5'	0° 6'	0° 7'	0° 8'	0° 9'	"
0		6.463726	6.464756	6.465847	7.065786	7.162696	7.241877	7.308824	7.366816	7.417968	60
1	4.685575	6.470905	6.4768360	6.483253	7.067592	7.164141	7.243082	7.309857	7.367719	7.418772	59
2	4.986605	6.477966	6.4771935	6.485646	7.069390	7.165582	7.244283	7.310887	7.368621	7.419574	58
3	5.162696	6.484915	6.4775480	6.4948026	7.071181	7.167017	7.245481	7.311915	7.369522	7.420374	57
4	5.287635	6.491755	6.4778996	6.4950393	7.072965	7.168448	7.246776	7.312940	7.370420	7.421173	56
5	5.384545	6.498488	6.4782485	6.4952746	7.074741	7.169874	7.247867	7.313963	7.371316	7.421971	55
6	5.463726	6.505119	6.4785945	6.4955088	7.076510	7.171296	7.249056	7.314984	7.372211	7.422767	54
7	5.530673	6.511650	6.4789379	6.4957416	7.078272	7.172713	7.250241	7.316002	7.373103	7.423562	53
8	5.588665	6.518084	6.4792785	6.4959733	7.080026	7.174125	7.251422	7.317018	7.373994	7.424355	52
9	5.639817	6.524424	6.4796164	6.4962037	7.081774	7.175533	7.252601	7.318032	7.374883	7.425147	51
10	5.685575	6.530673	6.4799518	6.4964328	7.083515	7.176936	7.253776	7.319043	7.375770	7.425937	50
11	5.726968	6.536833	6.4802846	6.4966608	7.085248	7.178335	7.254948	7.320052	7.376656	7.426726	49
12	5.764756	6.542907	6.4806149	6.4968876	7.086975	7.179729	7.256118	7.321058	7.377540	7.427513	48
13	5.799518	6.548898	6.4809426	6.4971132	7.088695	7.181119	7.257283	7.322062	7.378421	7.428299	47
14	5.831703	6.554807	6.4812680	6.4973376	7.090408	7.182504	7.258446	7.323064	7.379301	7.429084	46
15	5.861666	6.560636	6.4815909	6.4975609	7.092115	7.183885	7.259606	7.324064	7.380180	7.429867	45
16	5.889695	6.566388	6.4819114	6.4977831	7.093815	7.185262	7.260762	7.325061	7.381056	7.430649	44
17	5.916024	6.572066	6.4822295	6.4980041	7.095508	7.186634	7.261916	7.326056	7.381931	7.431429	43
18	5.940847	6.577629	6.4825454	6.4982240	7.097194	7.188002	7.263066	7.327049	7.382804	7.432208	42
19	5.964328	6.583202	6.4828590	6.4984428	7.098874	7.189365	7.264214	7.328039	7.383675	7.432986	41
20	5.986605	6.588665	6.4831793	6.4986605	7.100548	7.190725	7.265358	7.329027	7.384544	7.433762	40
21	6.00779	6.594060	6.4834794	6.4988771	7.102215	7.192080	7.266500	7.330013	7.385412	7.434537	39
22	6.027997	6.599389	6.4837863	6.4990926	7.103876	7.193431	7.267638	7.330997	7.386278	7.435311	38
23	6.047303	6.604653	6.4840911	6.4993071	7.105530	7.194777	7.268773	7.331978	7.387142	7.436083	37
24	6.065786	6.609854	6.4843937	6.4995205	7.107179	7.196120	7.269906	7.332957	7.388005	7.436853	36
25	6.083515	6.614994	6.4846943	6.4997329	7.108821	7.197458	7.271035	7.333934	7.388866	7.437631	35
26	6.100548	6.620073	6.4849928	6.4999442	7.110456	7.198792	7.272162	7.334909	7.389725	7.438391	34
27	6.116939	6.625094	6.4852892	7.001545	7.112086	7.200122	7.273286	7.335882	7.390582	7.439157	33
28	6.132733	6.630057	6.4855836	7.003638	7.113709	7.201448	7.274406	7.336852	7.391438	7.439923	32
29	6.147973	6.634965	6.4858761	7.005721	7.115327	7.202771	7.275524	7.337821	7.392292	7.440687	31
30	6.162696	6.639817	6.4861666	7.007794	7.116938	7.204089	7.276639	7.338787	7.393145	7.441449	30
31	6.176937	6.644616	6.4864552	7.009857	7.118544	7.205403	7.277751	7.339751	7.393995	7.442210	29
32	6.190725	6.649363	6.4867418	7.011911	7.120144	7.206713	7.278861	7.340713	7.394841	7.442970	28
33	6.204089	6.654058	6.4870266	7.013954	7.121737	7.208019	7.279967	7.341673	7.395692	7.443729	27
34	6.217054	6.658703	6.4873095	7.015989	7.123325	7.209321	7.281071	7.342630	7.396537	7.444486	26
35	6.229643	6.663298	6.4875906	7.018013	7.124907	7.210619	7.282172	7.343586	7.397382	7.445242	25
36	6.241877	6.667846	6.4878699	7.020028	7.126484	7.211914	7.283270	7.344539	7.398224	7.445997	24
37	6.253777	6.672347	6.4881474	7.022034	7.128054	7.213205	7.284365	7.345491	7.399065	7.446750	23
38	6.265358	6.676801	6.4884232	7.024031	7.129619	7.214491	7.285458	7.346440	7.399904	7.447502	22
39	6.276639	6.681210	6.4886972	7.026019	7.131179	7.215774	7.286547	7.347387	7.400742	7.448253	21
40	6.287635	6.685575	6.4889695	7.027997	7.132733	7.217054	7.287635	7.348332	7.401578	7.449002	20
41	6.298359	6.689896	6.4892401	7.029967	7.134281	7.218329	7.288719	7.349275	7.402412	7.449750	19
42	6.308824	6.694175	6.4895090	7.031928	7.135824	7.219601	7.289801	7.350216	7.403245	7.450497	18
43	6.319043	6.698412	6.4897762	7.033880	7.137361	7.220869	7.290880	7.351155	7.404076	7.451243	17
44	6.329027	6.702608	6.4900419	7.035823	7.138893	7.222133	7.291956	7.352092	7.404906	7.451987	16
45	6.338787	6.706764	6.4903059	7.037757	7.140420	7.223394	7.293030	7.353027	7.405734	7.452730	15
46	6.348333	6.710881	6.4905683	7.039683	7.141941	7.224651	7.294101	7.353960	7.406560	7.453472	14
47	6.357673	6.714959	6.4908291	7.041601	7.143457	7.225904	7.295169	7.354891	7.407385	7.454212	13
48	6.366816	6.718999	6.4910884	7.043510	7.144967	7.227154	7.296235	7.355820	7.408208	7.454952	12
49	6.375771	6.723001	6.4913461	7.045410	7.146473	7.228400	7.297298	7.356747	7.409030	7.455690	11
50	6.384545	6.726967	6.4916024	7.047303	7.147973	7.229643	7.298358	7.357672	7.409850	7.456426	10
51	6.393145	6.730898	6.4918571	7.049187	7.149468	7.230882	7.299416	7.358595	7.410659	7.457162	9
52	6.401578	6.734793	6.4921103	7.051063	7.150958	7.232117	7.300472	7.359516	7.411480	7.457896	8
53	6.409851	6.738653	6.4923621	7.052931	7.152442	7.233349	7.301525	7.360436	7.412302	7.458629	7
54	6.417969	6.742480	6.4926124	7.054791	7.153922	7.234578	7.302575	7.361353	7.413116	7.459361	6
55	6.425938	6.746273	6.4928613	7.056643	7.155397	7.235803	7.303623	7.362268	7.413928	7.460091	5
56	6.433763	6.750033	6.4931087	7.058487	7.156866	7.237025	7.304668	7.363181	7.414739	7.460822	4
57	6.441450	6.753761	6.4933548	7.060323	7.158331	7.238243	7.305711	7.364093	7.415549	7.461549	3
58	6.449003	6.757457	6.4935995	7.062152	7.159791	7.239458	7.306751	7.365002	7.416357	7.462275	2
59	6.456427	6.761122	6.4938428	7.063973	7.161246	7.240669	7.307789	7.365910	7.417163	7.463003	1
60	6.463726	6.764756	6.4940847	7.065786	7.162696	7.241877	7.308824	7.366816	7.417968	7.463725	0
"	89° 59'	89° 58'	89° 57'	89° 56'	89° 55'	89° 54'	89° 53'	89° 52'	89° 51'	89° 50'	"

LOG. COSINE TO SECONDS.

LOG. SINE TO SECONDS. (s.)

"	0° 10'	0° 11'	0° 12'	0° 13'	0° 14'	0° 15'	0° 16'	0° 17'	0° 18'	0° 19'	"
0	7.463725	7.505118	7.542906	7.577668	7.609853	7.639816	7.667844	7.694173	7.718997	7.742477	60
1	7.464449	7.505776	7.543509	7.578225	7.610370	7.640298	7.668297	7.694599	7.719399	7.742858	59
2	7.465171	7.506432	7.544111	7.578781	7.610886	7.640780	7.668748	7.695024	7.719800	7.743239	58
3	7.465892	7.507088	7.544712	7.579336	7.611401	7.641261	7.669200	7.695449	7.720201	7.743619	57
4	7.466611	7.507742	7.545312	7.579890	7.611916	7.641742	7.669650	7.695873	7.720602	7.743999	56
5	7.467330	7.508396	7.545912	7.580433	7.612430	7.642222	7.670101	7.696297	7.721003	7.744378	55
6	7.468047	7.509048	7.546511	7.580996	7.612944	7.642702	7.670550	7.696720	7.721403	7.744757	54
7	7.468763	7.509700	7.547108	7.581548	7.613457	7.643181	7.671000	7.697143	7.721802	7.745136	53
8	7.469478	7.510351	7.547705	7.582100	7.613969	7.643659	7.671449	7.697566	7.722202	7.745514	52
9	7.470191	7.511006	7.548301	7.582651	7.614481	7.644137	7.671897	7.697988	7.722601	7.745893	51
10	7.470904	7.511649	7.548897	7.583201	7.614993	7.644615	7.672345	7.698410	7.722999	7.746270	50
11	7.471615	7.512297	7.549491	7.583750	7.615503	7.645092	7.672792	7.698832	7.723398	7.746648	49
12	7.472326	7.512943	7.550085	7.584299	7.616013	7.645568	7.673239	7.699253	7.723795	7.747025	48
13	7.473035	7.513589	7.550678	7.584847	7.616523	7.646044	7.673686	7.699673	7.724193	7.747402	47
14	7.473743	7.514234	7.551270	7.585394	7.617031	7.646520	7.674132	7.700094	7.724590	7.747778	46
15	7.474449	7.514878	7.551861	7.585941	7.617540	7.646994	7.674578	7.700513	7.724987	7.748155	45
16	7.475155	7.515521	7.552452	7.586487	7.618047	7.647469	7.675023	7.700933	7.725383	7.748530	44
17	7.475859	7.516163	7.553041	7.587032	7.618554	7.647943	7.675468	7.701352	7.725779	7.748906	43
18	7.476563	7.516804	7.553630	7.587577	7.619061	7.648416	7.675912	7.701770	7.726175	7.749281	42
19	7.477265	7.517444	7.554218	7.588121	7.619567	7.648889	7.676356	7.702189	7.726570	7.749656	41
20	7.477966	7.518083	7.554806	7.588664	7.620072	7.649361	7.676799	7.702606	7.726965	7.750031	40
21	7.478666	7.518721	7.555392	7.589206	7.620577	7.649833	7.677242	7.703024	7.727360	7.750405	39
22	7.479365	7.519358	7.555978	7.589748	7.621081	7.650304	7.677685	7.703441	7.727754	7.750779	38
23	7.480062	7.519995	7.556563	7.590289	7.621584	7.650775	7.678127	7.703857	7.728148	7.751152	37
24	7.480759	7.520630	7.557147	7.590830	7.622087	7.651245	7.678568	7.704273	7.728542	7.751525	36
25	7.481454	7.521265	7.557730	7.591370	7.622590	7.651715	7.679009	7.704689	7.728935	7.751898	35
26	7.482148	7.521898	7.558313	7.591909	7.623091	7.652184	7.679450	7.705105	7.729328	7.752271	34
27	7.482842	7.522531	7.558894	7.592447	7.623593	7.652653	7.679890	7.705520	7.729720	7.752643	33
28	7.483534	7.523162	7.559475	7.592985	7.624093	7.653121	7.680330	7.705934	7.730112	7.753015	32
29	7.484225	7.523793	7.560056	7.593522	7.624593	7.653589	7.680769	7.706348	7.730504	7.753387	31
30	7.484915	7.524423	7.560635	7.594059	7.625093	7.654056	7.681208	7.706762	7.730896	7.753758	30
31	7.485603	7.525052	7.561214	7.594595	7.625592	7.654523	7.681647	7.707176	7.731287	7.754129	29
32	7.486291	7.525680	7.561792	7.595130	7.626090	7.654989	7.682085	7.707589	7.731678	7.754500	28
33	7.486978	7.526307	7.562369	7.595664	7.626588	7.655455	7.682522	7.708001	7.732068	7.754870	27
34	7.487663	7.526933	7.562945	7.596198	7.627085	7.655920	7.682960	7.708414	7.732458	7.755241	26
35	7.488348	7.527559	7.563521	7.596731	7.627582	7.656385	7.683396	7.708825	7.732848	7.755610	25
36	7.489031	7.528183	7.564096	7.597264	7.628078	7.656849	7.683832	7.709237	7.733237	7.755980	24
37	7.489714	7.528807	7.564670	7.597796	7.628573	7.657313	7.684268	7.709648	7.733626	7.756349	23
38	7.490395	7.529429	7.565243	7.598327	7.629068	7.657776	7.684704	7.710059	7.734014	7.756718	22
39	7.491075	7.530051	7.565816	7.598858	7.629562	7.658239	7.685139	7.710469	7.734403	7.757086	21
40	7.491754	7.530672	7.566387	7.599388	7.630056	7.658701	7.685573	7.710879	7.734791	7.757454	20
41	7.492432	7.531292	7.566958	7.599917	7.630549	7.659163	7.686007	7.711288	7.735178	7.757822	19
42	7.493109	7.531911	7.567529	7.600445	7.631042	7.659624	7.686441	7.711697	7.735566	7.758190	18
43	7.493787	7.532529	7.568098	7.600973	7.631534	7.660085	7.686874	7.712106	7.735952	7.758557	17
44	7.494460	7.533147	7.568667	7.601501	7.632026	7.660545	7.687307	7.712515	7.736339	7.758924	16
45	7.495134	7.533763	7.569235	7.602028	7.632517	7.661005	7.687739	7.712922	7.736725	7.759291	15
46	7.495807	7.534379	7.569803	7.602554	7.633007	7.661464	7.688171	7.713330	7.737111	7.759657	14
47	7.496478	7.534993	7.570359	7.603079	7.633497	7.661923	7.688603	7.713737	7.737497	7.760023	13
48	7.497149	7.535607	7.570935	7.603604	7.633986	7.662382	7.689034	7.714144	7.737882	7.760389	12
49	7.497819	7.536220	7.571500	7.604128	7.634475	7.662839	7.689464	7.714551	7.738267	7.760754	11
50	7.498487	7.536832	7.572065	7.604652	7.634963	7.663297	7.689894	7.714957	7.738651	7.761119	10
51	7.499155	7.537444	7.572628	7.605175	7.635451	7.663754	7.690324	7.715362	7.739035	7.761484	9
52	7.499822	7.538054	7.573191	7.605697	7.635938	7.664210	7.690754	7.715768	7.739419	7.761849	8
53	7.500487	7.538663	7.573753	7.606219	7.636425	7.664666	7.691183	7.716173	7.739803	7.762213	7
54	7.501152	7.539272	7.574315	7.606740	7.636911	7.665122	7.691611	7.716577	7.740186	7.762577	6
55	7.501815	7.539880	7.574875	7.607260	7.637396	7.665577	7.692039	7.716981	7.740568	7.762940	5
56	7.502478	7.540487	7.575436	7.607780	7.637881	7.666031	7.692467	7.717385	7.740951	7.763304	4
57	7.503139	7.541093	7.575995	7.608299	7.638366	7.666485	7.692894	7.717789	7.741333	7.763667	3
58	7.503800	7.541698	7.576553	7.608818	7.638850	7.666939	7.693321	7.718192	7.741715	7.764029	2
59	7.504459	7.542303	7.577111	7.609336	7.639333	7.667392	7.693747	7.718594	7.742096	7.764392	1
60	7.505118	7.542906	7.577668	7.609853	7.639816	7.667844	7.694173	7.718997	7.742477	7.764754	0
	89° 49'	89° 48'	89° 47'	89° 46'	89° 45'	89° 44'	89° 43'	89° 42'	89° 41'	89° 40'	"

LOG COSINE TO SECONDS.

LOG. SINE TO SECONDS. (s.)

'	0° 20'	0° 21'	0° 22'	0° 23'	0° 24'	0° 25'	0° 26'	0° 27'	0° 28'	0° 29'	"
0	7.764754	7.785943	7.806146	7.825451	7.843934	7.861662	7.878695	7.895085	7.910879	7.926119	60
1	7.765115	7.786287	7.806475	7.825765	7.844235	7.861952	7.878974	7.895353	7.911138	7.926368	59
2	7.765477	7.786631	7.806803	7.826080	7.844537	7.862241	7.879252	7.895621	7.911396	7.926618	58
3	7.765838	7.786975	7.807132	7.826335	7.844838	7.862530	7.879550	7.895889	7.911654	7.926867	57
4	7.766199	7.787319	7.807460	7.826708	7.845138	7.862819	7.879807	7.896156	7.911912	7.927116	56
5	7.766559	7.787663	7.807788	7.827021	7.845439	7.863107	7.880085	7.896424	7.912170	7.927365	55
6	7.766920	7.788006	7.808115	7.827335	7.845749	7.863396	7.880362	7.896691	7.912428	7.927614	54
7	7.767280	7.788349	7.808443	7.827648	7.846040	7.863681	7.880640	7.896958	7.912685	7.927863	53
8	7.767639	7.788691	7.808776	7.827961	7.846340	7.863972	7.880917	7.897225	7.912942	7.928111	52
9	7.767999	7.789034	7.809097	7.828274	7.846640	7.864260	7.881194	7.897491	7.913200	7.928359	51
10	7.768358	7.789376	7.809423	7.828586	7.846939	7.864548	7.881470	7.897758	7.913457	7.928608	50
11	7.768716	7.789718	7.809750	7.828899	7.847239	7.864835	7.88174	7.898024	7.913714	7.928856	49
12	7.769075	7.790059	7.810076	7.829211	7.847538	7.865123	7.882023	7.898290	7.913970	7.929104	48
13	7.769433	7.790400	7.810402	7.829523	7.847837	7.865410	7.882299	7.898556	7.914227	7.929352	47
14	7.769791	7.790741	7.810728	7.829834	7.848136	7.865697	7.882575	7.898852	7.914483	7.929599	46
15	7.770149	7.791082	7.811053	7.830146	7.848431	7.865984	7.882851	7.899088	7.914740	7.929847	45
16	7.770506	7.791423	7.811378	7.830457	7.848731	7.866276	7.883127	7.899354	7.914996	7.930094	44
17	7.770863	7.791763	7.811703	7.830768	7.849031	7.866556	7.883402	7.899619	7.915252	7.930341	43
18	7.771220	7.792103	7.812028	7.831079	7.849329	7.866843	7.883678	7.899884	7.915508	7.930588	42
19	7.771576	7.792443	7.812352	7.831389	7.849626	7.867129	7.883953	7.900149	7.915763	7.930835	41
20	7.771932	7.792782	7.812677	7.831700	7.849924	7.867414	7.884228	7.900414	7.916019	7.931082	40
21	7.772288	7.793121	7.813001	7.832100	7.850221	7.867700	7.884502	7.900679	7.916274	7.931329	39
22	7.772643	7.793460	7.813324	7.832319	7.850519	7.867986	7.884777	7.900943	7.916529	7.931575	38
23	7.772999	7.793799	7.813648	7.832629	7.850816	7.868271	7.885051	7.901208	7.916785	7.931822	37
24	7.773354	7.794137	7.813971	7.832939	7.851112	7.868556	7.885326	7.901472	7.917039	7.932068	36
25	7.773708	7.794475	7.814294	7.833248	7.851409	7.868841	7.885600	7.901736	7.917294	7.932314	35
26	7.774063	7.794813	7.814617	7.833557	7.851705	7.869125	7.885874	7.902000	7.917549	7.932560	34
27	7.774417	7.795151	7.814939	7.833866	7.852001	7.869410	7.886147	7.902264	7.917803	7.932806	33
28	7.774771	7.795488	7.815262	7.834174	7.852297	7.869694	7.886421	7.902527	7.918058	7.933052	32
29	7.775124	7.795825	7.815584	7.834482	7.852593	7.869978	7.886694	7.902791	7.918312	7.933297	31
30	7.775477	7.796162	7.815905	7.834791	7.852888	7.870262	7.886968	7.903054	7.918566	7.933543	30
31	7.775830	7.796498	7.816227	7.835098	7.853184	7.870546	7.887241	7.903317	7.918820	7.933788	29
32	7.776183	7.796834	7.816548	7.835406	7.853479	7.870830	7.887514	7.903580	7.919074	7.934033	28
33	7.776535	7.797170	7.816859	7.835714	7.853774	7.871113	7.887786	7.903843	7.919327	7.934278	27
34	7.776887	7.797506	7.817190	7.836021	7.854069	7.871396	7.888059	7.904106	7.919581	7.934523	26
35	7.777239	7.797842	7.817511	7.836328	7.854363	7.871679	7.888331	7.904368	7.919834	7.934768	25
36	7.777591	7.798177	7.817831	7.836635	7.854657	7.871962	7.888603	7.904630	7.920087	7.935012	24
37	7.777942	7.798512	7.818152	7.836941	7.854952	7.872245	7.888875	7.904895	7.920340	7.935257	23
38	7.778293	7.798847	7.818471	7.837248	7.855246	7.872527	7.889147	7.905155	7.920593	7.935501	22
39	7.778644	7.799181	7.818791	7.837554	7.855539	7.872809	7.889419	7.905417	7.920846	7.935745	21
40	7.778994	7.799515	7.819111	7.837860	7.855833	7.873092	7.889690	7.905678	7.921098	7.935989	20
41	7.779344	7.799849	7.819430	7.838165	7.856126	7.873373	7.889962	7.905940	7.921351	7.936233	19
42	7.779694	7.800183	7.819749	7.838471	7.856419	7.873655	7.890233	7.906201	7.921603	7.936477	18
43	7.780043	7.800516	7.820068	7.838776	7.856712	7.873937	7.890504	7.906462	7.921855	7.936721	17
44	7.780393	7.800850	7.820386	7.839081	7.857005	7.874218	7.890775	7.906723	7.922107	7.936964	16
45	7.780742	7.801182	7.820704	7.839386	7.857298	7.874499	7.891045	7.906984	7.922359	7.937208	15
46	7.781090	7.801515	7.821022	7.839691	7.857590	7.874780	7.891316	7.907245	7.922611	7.937451	14
47	7.781439	7.801847	7.821340	7.839995	7.857882	7.875061	7.891586	7.907506	7.922862	7.937694	13
48	7.781787	7.802180	7.821658	7.840300	7.858174	7.875342	7.891856	7.907766	7.923113	7.937937	12
49	7.782135	7.802512	7.821975	7.840604	7.858466	7.875622	7.892126	7.908026	7.923366	7.938180	11
50	7.782482	7.802843	7.822292	7.841907	7.858757	7.875902	7.892396	7.908287	7.923619	7.938422	10
51	7.782829	7.803175	7.822609	7.842111	7.859049	7.876183	7.892666	7.908547	7.923867	7.938665	9
52	7.783176	7.803506	7.822926	7.842314	7.859340	7.876462	7.892935	7.908806	7.924118	7.938907	8
53	7.783523	7.803837	7.823242	7.842518	7.859631	7.876742	7.893205	7.909066	7.924368	7.939150	7
54	7.783870	7.804167	7.823558	7.842720	7.859922	7.877022	7.893474	7.909326	7.924619	7.939392	6
55	7.784216	7.804498	7.823874	7.842923	7.860212	7.877301	7.893743	7.909585	7.924869	7.939634	5
56	7.784562	7.804828	7.824190	7.843226	7.860503	7.877580	7.894012	7.909844	7.925119	7.939876	4
57	7.784907	7.805158	7.824506	7.843528	7.860793	7.877859	7.894280	7.910103	7.925370	7.940117	3
58	7.785253	7.805487	7.824821	7.843833	7.861083	7.878138	7.894545	7.910362	7.925619	7.940359	2
59	7.785598	7.805817	7.825136	7.844136	7.861373	7.878417	7.894817	7.910621	7.925869	7.940600	1
60	7.785943	7.806146	7.825451	7.844394	7.861662	7.878695	7.895085	7.910899	7.926119	7.940842	0
"	89° 39'	89° 38'	89° 37'	89° 36'	89° 35'	89° 34'	89° 33'	89° 32'	89° 31'	89° 30'	"

LOG. COSINE TO SECONDS.

LOG. SINE TO SECONDS. (s.)

"	0° 30'	0° 31'	0° 32'	0° 33'	0° 34'	0° 35'	0° 36'	0° 37'	0° 38'	0° 39'	"
0	7.940842	7.955082	7.968870	7.982233	7.995198	8.007787	8.020021	8.031919	8.043501	8.054781	60
1	7.941083	7.955315	7.969096	7.982453	7.995411	8.007993	8.020222	8.032115	8.043691	8.054967	59
2	7.941324	7.955549	7.969322	7.982672	7.995623	8.008200	8.020423	8.032310	8.043882	8.055152	58
3	7.941565	7.955782	7.969548	7.982891	7.995836	8.008407	8.020623	8.032506	8.044072	8.055338	57
4	7.941806	7.956015	7.969774	7.983110	7.996049	8.008613	8.020824	8.032701	8.044262	8.055523	56
5	7.942046	7.956248	7.969999	7.983329	7.996261	8.008819	8.021025	8.032896	8.044452	8.055708	55
6	7.942287	7.956481	7.970225	7.983547	7.996473	8.009026	8.021225	8.033092	8.044642	8.055893	54
7	7.942527	7.956713	7.970450	7.983766	7.996686	8.009232	8.021426	8.033287	8.044832	8.056079	53
8	7.942768	7.956946	7.970676	7.983984	7.996898	8.009438	8.021626	8.033482	8.045022	8.056264	52
9	7.943008	7.957178	7.970901	7.984203	7.997110	8.009644	8.021826	8.033676	8.045212	8.056448	51
10	7.943248	7.957410	7.971126	7.984421	7.997322	8.009850	8.022027	8.033871	8.045401	8.056633	50
11	7.943488	7.957643	7.971351	7.984639	7.997533	8.010055	8.022227	8.034066	8.045591	8.056818	49
12	7.943727	7.957875	7.971576	7.984857	7.997745	8.010261	8.022427	8.034261	8.045780	8.057003	48
13	7.943967	7.958107	7.971800	7.985075	7.997957	8.010467	8.022627	8.034455	8.045970	8.057187	47
14	7.944207	7.958338	7.972025	7.985293	7.998168	8.010672	8.022826	8.034649	8.046159	8.057372	46
15	7.944446	7.958570	7.972249	7.985511	7.998379	8.010878	8.023026	8.034844	8.046349	8.057556	45
16	7.944685	7.958802	7.972474	7.985729	7.998591	8.011083	8.023226	8.035038	8.046538	8.057741	44
17	7.944924	7.959033	7.972698	7.985946	7.998802	8.011288	8.023425	8.035232	8.046727	8.057923	43
18	7.945163	7.959264	7.972922	7.986164	7.999013	8.011493	8.023625	8.035426	8.046916	8.058109	42
19	7.945402	7.959496	7.973146	7.986381	7.999224	8.011698	8.023824	8.035620	8.047105	8.058293	41
20	7.945641	7.959727	7.973370	7.986598	7.999435	8.011903	8.024023	8.035814	8.047294	8.058477	40
21	7.945879	7.959958	7.973594	7.986815	7.999646	8.012108	8.024222	8.036008	8.047482	8.058661	39
22	7.946118	7.960188	7.973818	7.987032	7.999856	8.012311	8.024421	8.036202	8.047671	8.058845	38
23	7.946356	7.960419	7.974041	7.987249	8.000067	8.012517	8.024620	8.036396	8.047860	8.059029	37
24	7.946594	7.960650	7.974265	7.987466	8.000277	8.012722	8.024819	8.036589	8.048048	8.059211	36
25	7.946832	7.960880	7.974488	7.987682	8.000488	8.012926	8.025018	8.036783	8.048237	8.059396	35
26	7.947070	7.961110	7.974711	7.987899	8.000698	8.013130	8.025217	8.036976	8.048425	8.059580	34
27	7.947308	7.961341	7.974934	7.988115	8.000908	8.013335	8.025415	8.037169	8.048613	8.059764	33
28	7.947545	7.961571	7.975157	7.988332	8.001118	8.013539	8.025614	8.037363	8.048802	8.059947	32
29	7.947783	7.961801	7.975380	7.988548	8.001328	8.013743	8.025812	8.037556	8.048990	8.060130	31
30	7.948020	7.962031	7.975603	7.988764	8.001538	8.013947	8.026011	8.037749	8.049178	8.060314	30
31	7.948257	7.962260	7.975826	7.988980	8.001748	8.014151	8.026209	8.037942	8.049366	8.060497	29
32	7.948495	7.962490	7.976049	7.989196	8.001957	8.014354	8.026407	8.038135	8.049554	8.060680	28
33	7.948732	7.962719	7.976271	7.989412	8.002167	8.014558	8.026605	8.038327	8.049741	8.060863	27
34	7.948968	7.962949	7.976493	7.989627	8.002376	8.014761	8.026803	8.038520	8.049929	8.061046	26
35	7.949205	7.963178	7.976715	7.989843	8.002586	8.014965	8.027001	8.038713	8.050117	8.061229	25
36	7.949442	7.963407	7.976937	7.990058	8.002795	8.015168	8.027199	8.038905	8.050304	8.061412	24
37	7.949678	7.963636	7.977159	7.990274	8.003004	8.015372	8.027397	8.039098	8.050492	8.061594	23
38	7.949915	7.963865	7.977381	7.990489	8.003213	8.015575	8.027594	8.039290	8.050679	8.061777	22
39	7.950151	7.964094	7.977603	7.990704	8.003422	8.015778	8.027792	8.039482	8.050866	8.061960	21
40	7.950387	7.964322	7.977824	7.990919	8.003631	8.015981	8.027989	8.039675	8.051054	8.062142	20
41	7.950623	7.964551	7.978046	7.991134	8.003840	8.016184	8.028187	8.039867	8.051241	8.062325	19
42	7.950859	7.964779	7.978267	7.991349	8.004048	8.016386	8.028384	8.040059	8.051428	8.062507	18
43	7.951094	7.965007	7.978489	7.991564	8.004257	8.016589	8.028581	8.040251	8.051615	8.062689	17
44	7.951330	7.965236	7.978710	7.991778	8.004465	8.016792	8.028778	8.040443	8.051802	8.062871	16
45	7.951565	7.965464	7.978931	7.991993	8.004673	8.016994	8.028975	8.040634	8.051989	8.063054	15
46	7.951801	7.965692	7.979152	7.992207	8.004882	8.017197	8.029172	8.040826	8.052175	8.063236	14
47	7.952036	7.965919	7.979373	7.992422	8.005090	8.017399	8.029369	8.041018	8.052362	8.063418	13
48	7.952271	7.966147	7.979593	7.992636	8.005298	8.017601	8.029566	8.041209	8.052549	8.063599	12
49	7.952506	7.966375	7.979814	7.992850	8.005506	8.017803	8.029762	8.041401	8.052735	8.063781	11
50	7.952741	7.966602	7.980034	7.993064	8.005714	8.018005	8.029959	8.041592	8.052922	8.063963	10
51	7.952975	7.966829	7.980255	7.993278	8.005921	8.018207	8.030155	8.041783	8.053108	8.064145	9
52	7.953210	7.967056	7.980475	7.993491	8.006129	8.018409	8.030352	8.041974	8.053294	8.064326	8
53	7.953444	7.967284	7.980695	7.993705	8.006337	8.018611	8.030548	8.042165	8.053480	8.064508	7
54	7.953679	7.967511	7.980915	7.993919	8.006544	8.018813	8.030744	8.042356	8.053666	8.064689	6
55	7.953913	7.967737	7.981135	7.994132	8.006751	8.019014	8.030940	8.042547	8.053852	8.064871	5
56	7.954147	7.967966	7.981355	7.994346	8.006959	8.019216	8.031136	8.042738	8.054038	8.065052	4
57	7.954381	7.968191	7.981575	7.994559	8.007166	8.019417	8.031332	8.042929	8.054224	8.065233	3
58	7.954615	7.968417	7.981794	7.994772	8.007373	8.019618	8.031528	8.043120	8.054410	8.065414	2
59	7.954848	7.968644	7.982014	7.994985	8.007580	8.019820	8.031724	8.043311	8.054596	8.065595	1
60	7.955082	7.968870	7.982233	7.995198	8.007787	8.020021	8.031919	8.043501	8.054781	8.065776	0
"	89° 20'	89° 28'	89° 27'	89° 26'	89° 25'	89° 24'	89° 23'	89° 22'	89° 21'	89° 20'	"

LOG. COSINE TO SECONDS.

LOG. SINE TO SECONDS. (s.)

"	0° 40'	0° 41'	0° 42'	0° 43'	0° 44'	0° 45'	0° 46'	0° 47'	0° 48'	0° 49'	"
0	8.065776	8.076500	8.086965	8.097183	8.107167	8.116926	8.126471	8.135810	8.144953	8.153907	50
1	8.065957	8.076676	8.087137	8.097351	8.107331	8.117987	8.126628	8.135964	8.145104	8.154055	59
2	8.066138	8.076853	8.087309	8.097520	8.107496	8.117248	8.126786	8.136118	8.145255	8.154203	58
3	8.066319	8.077029	8.087481	8.097688	8.107660	8.117408	8.126943	8.136272	8.145405	8.154350	57
4	8.066499	8.077205	8.087653	8.097856	8.107824	8.117569	8.127100	8.136426	8.145556	8.154498	56
5	8.066680	8.077381	8.087825	8.098024	8.107989	8.117730	8.127257	8.136580	8.145706	8.154645	55
6	8.066861	8.077558	8.087997	8.098192	8.108153	8.117890	8.127414	8.136733	8.145857	8.154793	54
7	8.067041	8.077734	8.088169	8.098360	8.108317	8.118051	8.127571	8.136887	8.146007	8.154940	53
8	8.067221	8.077910	8.088341	8.098528	8.108481	8.118211	8.127728	8.137041	8.146158	8.155088	52
9	8.067402	8.078086	8.088513	8.098695	8.108645	8.118371	8.127885	8.137194	8.146308	8.155235	51
10	8.067582	8.078261	8.088684	8.098863	8.108809	8.118532	8.128042	8.137348	8.146458	8.155382	50
11	8.067762	8.078437	8.088856	8.099031	8.108973	8.118692	8.128198	8.137501	8.146609	8.155529	49
12	8.067942	8.078613	8.089028	8.099198	8.109136	8.118852	8.128355	8.137654	8.146759	8.155676	48
13	8.068122	8.078789	8.089199	8.099366	8.109300	8.119012	8.128512	8.137805	8.146909	8.155823	47
14	8.068302	8.078964	8.089371	8.099533	8.109464	8.119172	8.128668	8.137961	8.147059	8.155970	46
15	8.068482	8.079140	8.089542	8.099701	8.109627	8.119332	8.128825	8.138114	8.147209	8.156117	45
16	8.068662	8.079315	8.089713	8.099868	8.109791	8.119492	8.128981	8.138267	8.147359	8.156264	44
17	8.068842	8.079490	8.089884	8.100035	8.109954	8.119652	8.129138	8.138420	8.147509	8.156411	43
18	8.069021	8.079666	8.090055	8.100202	8.110118	8.119812	8.129294	8.138574	8.147659	8.156558	42
19	8.069201	8.079841	8.090227	8.100370	8.110281	8.119971	8.129450	8.138726	8.147809	8.156705	41
20	8.069380	8.080016	8.090398	8.100537	8.110444	8.120131	8.129606	8.138789	8.147959	8.156852	40
21	8.069560	8.080191	8.090568	8.100704	8.110608	8.120291	8.129763	8.139032	8.148108	8.156998	39
22	8.069739	8.080366	8.090739	8.100871	8.110771	8.120450	8.129919	8.139185	8.148258	8.157145	38
23	8.069918	8.080541	8.090910	8.101037	8.110934	8.120610	8.130075	8.139333	8.148408	8.157292	37
24	8.070097	8.080716	8.091081	8.101204	8.111097	8.120769	8.130231	8.139491	8.148557	8.157438	36
25	8.070277	8.080891	8.091252	8.101371	8.111260	8.120929	8.130387	8.139643	8.148707	8.157585	35
26	8.070456	8.081065	8.091422	8.101538	8.111425	8.121088	8.130543	8.139796	8.148856	8.157731	34
27	8.070635	8.081240	8.091593	8.101704	8.111586	8.121247	8.130699	8.139948	8.149005	8.157877	33
28	8.070813	8.081415	8.091763	8.101871	8.111749	8.121407	8.130854	8.140103	8.149155	8.158024	32
29	8.070992	8.081589	8.091934	8.102037	8.111911	8.121566	8.131010	8.140253	8.149304	8.158170	31
30	8.071171	8.081764	8.092104	8.102204	8.112074	8.121725	8.131166	8.140406	8.149453	8.158316	30
31	8.071350	8.081938	8.092274	8.102370	8.112237	8.121884	8.131321	8.140558	8.149603	8.158462	29
32	8.071528	8.082112	8.092444	8.102536	8.112399	8.122043	8.131477	8.140710	8.149752	8.158609	28
33	8.071707	8.082287	8.092615	8.102703	8.112562	8.122202	8.131632	8.140863	8.149901	8.158753	27
34	8.071885	8.082461	8.092785	8.102869	8.112724	8.122361	8.131788	8.141015	8.150050	8.158901	26
35	8.072064	8.082635	8.092955	8.103035	8.112886	8.122519	8.131943	8.141167	8.150199	8.159047	25
36	8.072242	8.082809	8.093125	8.103201	8.113049	8.122678	8.132099	8.141319	8.150348	8.159193	24
37	8.072420	8.082983	8.093294	8.103367	8.113211	8.122837	8.132254	8.141471	8.150497	8.159339	23
38	8.072598	8.083157	8.093464	8.103533	8.113373	8.122996	8.132409	8.141623	8.150646	8.159484	22
39	8.072776	8.083330	8.093634	8.103699	8.113535	8.123154	8.132564	8.141775	8.150794	8.159630	21
40	8.072955	8.083504	8.093804	8.103864	8.113697	8.123313	8.132720	8.141927	8.150943	8.159776	20
41	8.073132	8.083678	8.093973	8.104030	8.113859	8.123471	8.132875	8.142079	8.151092	8.159922	19
42	8.073310	8.083851	8.094143	8.104196	8.114021	8.123629	8.133030	8.142231	8.151241	8.160067	18
43	8.073488	8.084025	8.094312	8.104361	8.114183	8.123788	8.133185	8.142382	8.151389	8.160213	17
44	8.073666	8.084198	8.094482	8.104527	8.114345	8.123946	8.133339	8.142534	8.151538	8.160358	16
45	8.073844	8.084372	8.094651	8.104692	8.114507	8.124104	8.133494	8.142685	8.151686	8.160504	15
46	8.074021	8.084545	8.094820	8.104858	8.114669	8.124263	8.133649	8.142837	8.151835	8.160649	14
47	8.074199	8.084718	8.094989	8.105023	8.114830	8.124421	8.133804	8.142989	8.151983	8.160795	13
48	8.074376	8.084892	8.095159	8.105188	8.114992	8.124579	8.133959	8.143140	8.152131	8.160940	12
49	8.074553	8.085065	8.095328	8.105354	8.115153	8.124737	8.134113	8.143291	8.152280	8.161086	11
50	8.074731	8.085238	8.095497	8.105519	8.115315	8.124895	8.134268	8.143443	8.152428	8.161231	10
51	8.074908	8.085411	8.095666	8.105684	8.115476	8.125053	8.134422	8.143594	8.152576	8.161376	9
52	8.075085	8.085584	8.095835	8.105849	8.115638	8.125210	8.134577	8.143745	8.152724	8.161521	8
53	8.075262	8.085757	8.096003	8.106014	8.115799	8.125368	8.134731	8.143896	8.152872	8.161666	7
54	8.075439	8.085929	8.096172	8.106179	8.115960	8.125526	8.134885	8.144004	8.153020	8.161811	6
55	8.075616	8.086102	8.096341	8.106344	8.116121	8.125684	8.135040	8.144199	8.153168	8.161956	5
56	8.075793	8.086275	8.096509	8.106508	8.116282	8.125841	8.135194	8.144350	8.153316	8.162101	4
57	8.075970	8.086447	8.096678	8.106673	8.116443	8.125999	8.135348	8.144501	8.153464	8.162246	3
58	8.076146	8.086620	8.096846	8.106838	8.116604	8.126156	8.135502	8.144652	8.153612	8.162391	2
59	8.076323	8.086792	8.097015	8.107002	8.116765	8.126314	8.135656	8.144802	8.153760	8.162536	1
60	8.076500	8.086965	8.097183	8.107167	8.116926	8.126471	8.135810	8.144953	8.153907	8.162681	0
"	89° 19'	89° 18'	89° 17'	89° 16'	89° 15'	89° 14'	89° 13'	89° 12'	89° 11'	89° 10'	"

LOG. COSINE TO SECONDS.

0 ^h or 0 ^m .		LOG. SINES, &c. (t.)						0 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	0.000000	Infinite.	0.000000	Infinite.	10.000000	10.000000	60	60
1	15	5.861666	14.138334	5.861666	14.138334	10.000000	10.000000	45	59
2	30	6.162696	13.837304	6.162696	13.837304	10.000000	10.000000	30	58
3	45	6.338787	13.661213	6.338787	13.661213	10.000000	10.000000	15	57
4	1	6.463726	13.536274	6.463726	13.536274	10.000000	10.000000	59	56
5	15	6.560636	13.439364	6.560636	13.439364	10.000000	10.000000	45	55
6	30	6.639817	13.360183	6.639817	13.360183	10.000000	10.000000	30	54
7	45	6.706764	13.293236	6.706764	13.293236	10.000000	10.000000	15	53
8	2	6.764756	13.235244	6.764756	13.235244	10.000000	10.000000	58	52
9	15	6.815909	13.184091	6.815909	13.184091	10.000000	10.000000	45	51
10	30	6.861666	13.138334	6.861666	13.138334	10.000000	10.000000	30	50
11	45	6.903059	13.096941	6.903059	13.096941	10.000000	10.000000	15	49
12	3	6.940847	13.059153	6.940847	13.059153	10.000000	10.000000	57	48
13	15	6.975609	13.024391	6.975610	13.024390	10.000000	10.000000	45	47
14	30	7.007794	12.992206	7.007794	12.992206	10.000000	10.000000	30	46
15	45	7.037757	12.962243	7.037755	12.962242	10.000000	10.000000	15	45
16	4	7.065786	12.934214	7.065786	12.934214	10.000000	10.000000	56	44
17	15	7.092115	12.907885	7.092115	12.907885	10.000000	10.000000	45	43
18	30	7.116938	12.883062	7.116939	12.883061	10.000000	10.000000	30	42
19	45	7.140420	12.859580	7.140420	12.859580	10.000000	10.000000	15	41
20	5	7.162696	12.837304	7.162696	12.837304	10.000000	10.000000	55	40
21	15	7.183885	12.816115	7.183886	12.816114	10.000000	10.000000	45	39
22	30	7.204089	12.795911	7.204089	12.795911	10.000000	10.000000	30	38
23	45	7.223394	12.776606	7.223394	12.776606	10.000001	9.999999	15	37
24	6	7.241877	12.758123	7.241878	12.758122	10.000001	9.999999	54	36
25	15	7.259506	12.740394	7.259507	12.740393	10.000001	9.999999	45	35
26	30	7.276639	12.723361	7.276640	12.723360	10.000001	9.999999	30	34
27	45	7.293030	12.706970	7.293030	12.706970	10.000001	9.999999	15	33
28	7	7.308824	12.691176	7.308825	12.691175	10.000001	9.999999	53	32
29	15	7.324064	12.675936	7.324065	12.675935	10.000001	9.999999	45	31
30	30	7.338787	12.661213	7.338788	12.661212	10.000001	9.999999	30	30
31	45	7.353029	12.646973	7.353029	12.646971	10.000001	9.999999	15	29
32	8	7.366816	12.633184	7.366817	12.633183	10.000001	9.999999	52	28
33	15	7.380180	12.619820	7.380181	12.619819	10.000001	9.999999	45	27
34	30	7.393145	12.606855	7.393146	12.606854	10.000001	9.999999	30	26
35	45	7.405734	12.594266	7.405735	12.594265	10.000002	9.999999	15	25
36	9	7.417963	12.582032	7.417970	12.582030	10.000002	9.999998	51	24
37	15	7.429867	12.570133	7.429869	12.570131	10.000002	9.999998	45	23
38	30	7.441449	12.558551	7.441451	12.558549	10.000002	9.999998	30	22
39	45	7.452732	12.547270	7.452732	12.547268	10.000002	9.999998	15	21
40	10	7.463725	12.536275	7.463727	12.536273	10.000002	9.999998	50	20
41	15	7.474449	12.525551	7.474451	12.525549	10.000002	9.999998	45	19
42	30	7.484915	12.515085	7.484917	12.515083	10.000002	9.999998	30	18
43	45	7.495134	12.504866	7.495136	12.504864	10.000002	9.999998	15	17
44	11	7.505118	12.494882	7.505120	12.494880	10.000002	9.999998	49	16
45	15	7.514878	12.485122	7.514880	12.485120	10.000002	9.999998	45	15
46	30	7.524426	12.475577	7.524426	12.475574	10.000002	9.999998	30	14
47	45	7.533763	12.466237	7.533766	12.466234	10.000003	9.999997	15	13
48	12	7.542906	12.457094	7.542909	12.457091	10.000003	9.999997	48	12
49	15	7.551861	12.448139	7.551864	12.448136	10.000003	9.999997	45	11
50	30	7.560638	12.439365	7.560638	12.439362	10.000003	9.999997	30	10
51	45	7.569235	12.430765	7.569238	12.430762	10.000003	9.999997	15	9
52	13	7.577668	12.422332	7.577671	12.422329	10.000003	9.999997	47	8
53	15	7.585941	12.414059	7.585944	12.414056	10.000003	9.999997	45	7
54	30	7.594059	12.405941	7.594062	12.405938	10.000004	9.999996	30	6
55	45	7.602028	12.397972	7.602031	12.397969	10.000004	9.999996	15	5
56	14	7.609853	12.390147	7.609857	12.390143	10.000004	9.999996	46	4
57	15	7.617540	12.382460	7.617543	12.382457	10.000004	9.999996	45	3
58	30	7.625093	12.374907	7.625097	12.374903	10.000004	9.999996	30	2
59	45	7.632517	12.367483	7.632521	12.367479	10.000004	9.999996	15	1
60	15	7.639816	12.360184	7.639820	12.360180	10.000004	9.999996	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant	sine.	"	sec.
5 ^h 59 ^m .		LOG. SINES, &c.						89 deg.	

0 ^h 1 ^m .		LOG. SINES, &c. (t.)						0 deg.	
sec.	"	sine	coscant.	tangent	cotangent	secant.	cosine.	"	sec.
0	15	7.639816	12.360184	7.639820	12.360180	10.000004	9.999996	45	60
1	15	7.646994	12.353006	7.646999	12.353001	10.000004	9.999996	45	59
2	30	7.654056	12.345944	7.654061	12.345939	10.000004	9.999996	30	58
3	45	7.661005	12.338995	7.661010	12.338990	10.000005	9.999995	15	57
4	16	7.667844	12.332156	7.667849	12.332151	10.000005	9.999995	44	56
5	15	7.674578	12.325422	7.674583	12.325417	10.000005	9.999995	45	55
6	30	7.681208	12.318792	7.681213	12.318787	10.000005	9.999995	30	54
7	45	7.687739	12.312261	7.687744	12.312256	10.000005	9.999995	15	53
8	17	7.694173	12.305827	7.694179	12.305821	10.000005	9.999995	43	52
9	15	7.700513	12.299487	7.700519	12.299481	10.000006	9.999994	45	51
10	30	7.706762	12.293238	7.706768	12.293232	10.000006	9.999994	30	50
11	45	7.712922	12.287078	7.712928	12.287072	10.000006	9.999994	15	49
12	18	7.718997	12.281003	7.719003	12.280997	10.000006	9.999994	42	48
13	15	7.724987	12.275013	7.724993	12.275007	10.000006	9.999994	45	47
14	30	7.730896	12.269104	7.730902	12.269098	10.000006	9.999994	30	46
15	45	7.736725	12.263275	7.736732	12.263268	10.000007	9.999993	15	45
16	19	7.742477	12.257523	7.742484	12.257516	10.000007	9.999993	41	44
17	15	7.748155	12.251845	7.748161	12.251839	10.000007	9.999993	45	43
18	30	7.753758	12.246242	7.753765	12.246235	10.000007	9.999993	30	42
19	45	7.759291	12.240709	7.759298	12.240702	10.000007	9.999993	15	41
20	20	7.764754	12.235246	7.764761	12.235239	10.000007	9.999993	40	40
21	15	7.770149	12.229851	7.770156	12.229844	10.000008	9.999992	45	39
22	30	7.775477	12.224523	7.775485	12.224515	10.000008	9.999992	30	38
23	45	7.780742	12.219258	7.780749	12.219251	10.000008	9.999992	15	37
24	21	7.785943	12.214057	7.785951	12.214049	10.000008	9.999992	39	36
25	15	7.791082	12.208918	7.791091	12.208909	10.000008	9.999992	45	35
26	30	7.796162	12.203838	7.796170	12.203830	10.000009	9.999991	30	34
27	45	7.801182	12.198818	7.801191	12.198809	10.000009	9.999991	15	33
28	22	7.806146	12.193854	7.806155	12.193845	10.000009	9.999991	38	32
29	15	7.811053	12.188947	7.811062	12.188938	10.000009	9.999991	45	31
30	30	7.815905	12.184095	7.815915	12.184085	10.000009	9.999991	30	30
31	45	7.820704	12.179296	7.820714	12.179286	10.000010	9.999990	15	29
32	23	7.825451	12.174549	7.825460	12.174540	10.000010	9.999990	37	28
33	15	7.830146	12.169854	7.830156	12.169844	10.000010	9.999990	45	27
34	30	7.834791	12.165209	7.834801	12.165199	10.000010	9.999990	30	26
35	45	7.839386	12.160614	7.839397	12.160603	10.000010	9.999990	15	25
36	24	7.843934	12.156066	7.843944	12.156056	10.000011	9.999989	36	24
37	15	7.848434	12.151566	7.848445	12.151555	10.000011	9.999989	45	23
38	30	7.852888	12.147112	7.852900	12.147100	10.000011	9.999989	30	22
39	45	7.857298	12.142702	7.857309	12.142691	10.000011	9.999989	15	21
40	25	7.861662	12.138338	7.861674	12.138326	10.000012	9.999988	35	20
41	15	7.865984	12.134016	7.865995	12.134005	10.000012	9.999988	45	19
42	30	7.870262	12.129738	7.870274	12.129726	10.000012	9.999988	30	18
43	45	7.874499	12.125501	7.874511	12.125489	10.000012	9.999988	15	17
44	26	7.878695	12.121305	7.878708	12.121292	10.000012	9.999988	34	16
45	15	7.882851	12.117149	7.882864	12.117136	10.000013	9.999987	45	15
46	30	7.886968	12.113032	7.886981	12.113019	10.000013	9.999987	30	14
47	45	7.891045	12.108955	7.891059	12.108941	10.000013	9.999987	15	13
48	27	7.895085	12.104915	7.895099	12.104901	10.000013	9.999987	33	12
49	15	7.899088	12.100912	7.899102	12.100898	10.000014	9.999986	45	11
50	30	7.903054	12.096946	7.903068	12.096932	10.000014	9.999986	30	10
51	45	7.906984	12.093016	7.906998	12.093002	10.000014	9.999986	15	9
52	28	7.910879	12.089121	7.910895	12.089106	10.000014	9.999986	32	8
53	15	7.914740	12.085260	7.914754	12.085246	10.000015	9.999985	45	7
54	30	7.918566	12.081434	7.918581	12.081419	10.000015	9.999985	30	6
55	45	7.922359	12.077641	7.922374	12.077626	10.000015	9.999985	15	5
56	29	7.926119	12.073881	7.926134	12.073866	10.000016	9.999984	31	4
57	15	7.929847	12.070153	7.929862	12.070138	10.000016	9.999984	45	3
58	30	7.933543	12.066457	7.933559	12.066441	10.000016	9.999984	30	2
59	45	7.937208	12.062792	7.937224	12.062776	10.000016	9.999984	15	1
60	30	7.940842	12.059158	7.940858	12.059142	10.000017	9.999983	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 58 ^m .		LOG. SINES, &c.						89 deg.	

0 ^h 2 ^m .			LOG. SINES, &c. (L.)				0 deg.		
sec.	"	sine.	cosecant.	tangent	cotangent.	secant.	cosine.	"	sec.
0	30	7.940842	12.059158	7.940858	12.059142	10.000017	9.999983	30	60
1	15	7.944446	12.055554	7.944463	12.055537	10.000017	9.999983	45	59
2	30	7.948020	12.051980	7.948037	12.051963	10.000017	9.999983	30	58
3	45	7.951565	12.048435	7.951583	12.048417	10.000017	9.999983	15	57
4	31	7.955082	12.044918	7.955100	12.044900	10.000018	9.999982	29	56
5	15	7.958570	12.041430	7.958588	12.041412	10.000018	9.999982	45	55
6	30	7.962031	12.037969	7.962049	12.037951	10.000018	9.999982	30	54
7	45	7.965464	12.034536	7.965482	12.034518	10.000019	9.999981	15	53
8	32	7.968870	12.031130	7.968889	12.031111	10.000019	9.999981	28	52
9	15	7.972249	12.027751	7.972269	12.027731	10.000019	9.999981	45	51
10	30	7.975603	12.024397	7.975622	12.024378	10.000019	9.999981	30	50
11	45	7.978931	12.021069	7.978951	12.021049	10.000020	9.999980	15	49
12	33	7.982233	12.017767	7.982253	12.017747	10.000020	9.999980	27	48
13	15	7.985511	12.014489	7.985531	12.014469	10.000020	9.999980	45	47
14	30	7.988764	12.011236	7.988785	12.011215	10.000021	9.999979	30	46
15	45	7.991993	12.008007	7.992014	12.007986	10.000021	9.999979	15	45
16	34	7.995198	12.004802	7.995219	12.004781	10.000021	9.999979	26	44
17	15	7.998379	12.001621	7.998401	12.001599	10.000022	9.999978	45	43
18	30	8.001538	11.998462	8.001560	11.998440	10.000022	9.999978	30	42
19	45	8.004736	11.995327	8.004696	11.995304	10.000022	9.999978	15	41
20	35	8.007787	11.992213	8.007809	11.992191	10.000023	9.999977	25	40
21	15	8.010878	11.989122	8.010900	11.989099	10.000023	9.999977	45	39
22	30	8.013947	11.986053	8.013970	11.986030	10.000023	9.999977	30	38
23	45	8.016994	11.983006	8.017018	11.982982	10.000024	9.999976	15	37
24	36	8.020021	11.979979	8.020044	11.979955	10.000024	9.999976	24	36
25	15	8.023026	11.976974	8.023050	11.976950	10.000024	9.999976	45	35
26	30	8.026011	11.973989	8.026035	11.973965	10.000025	9.999975	30	34
27	45	8.028975	11.971025	8.029000	11.971000	10.000025	9.999975	15	33
28	37	8.031919	11.968081	8.031945	11.968055	10.000025	9.999975	23	32
29	15	8.034844	11.965156	8.034869	11.965131	10.000026	9.999974	45	31
30	30	8.037749	11.962251	8.037775	11.962225	10.000026	9.999974	30	30
31	45	8.040634	11.959366	8.040660	11.959339	10.000026	9.999974	15	29
32	38	8.043501	11.956499	8.043527	11.956473	10.000027	9.999973	22	28
33	15	8.046349	11.953651	8.046375	11.953624	10.000027	9.999973	45	27
34	30	8.049178	11.950822	8.049205	11.950795	10.000027	9.999973	30	26
35	45	8.051989	11.948011	8.052016	11.947984	10.000028	9.999972	15	25
36	39	8.054781	11.945219	8.054809	11.945191	10.000028	9.999972	21	24
37	15	8.057556	11.942444	8.057585	11.942415	10.000028	9.999972	45	23
38	30	8.060314	11.939686	8.060342	11.939658	10.000029	9.999971	30	22
39	45	8.063054	11.936946	8.063083	11.936917	10.000029	9.999971	15	21
40	40	8.065776	11.934224	8.065806	11.934194	10.000029	9.999971	20	20
41	15	8.068482	11.931518	8.068512	11.931488	10.000030	9.999970	45	19
42	30	8.071171	11.928829	8.071201	11.928799	10.000030	9.999970	30	18
43	45	8.073844	11.926156	8.073874	11.926126	10.000031	9.999969	15	17
44	41	8.076500	11.923500	8.076531	11.923469	10.000031	9.999969	19	16
45	15	8.079140	11.920860	8.079171	11.920829	10.000031	9.999969	45	15
46	30	8.081764	11.918236	8.081795	11.918205	10.000032	9.999968	30	14
47	45	8.084372	11.915628	8.084404	11.915596	10.000032	9.999968	15	13
48	42	8.086965	11.913035	8.086997	11.913003	10.000032	9.999968	18	12
49	15	8.089542	11.910458	8.089575	11.910425	10.000033	9.999967	45	11
50	30	8.092104	11.907896	8.092137	11.907863	10.000033	9.999967	30	10
51	45	8.094651	11.905349	8.094685	11.905315	10.000034	9.999966	15	9
52	43	8.097183	11.902817	8.097217	11.902783	10.000034	9.999966	17	8
53	15	8.099701	11.900299	8.099735	11.900265	10.000034	9.999966	45	7
54	30	8.102204	11.897796	8.102239	11.897761	10.000035	9.999965	30	6
55	45	8.104692	11.895308	8.104728	11.895272	10.000035	9.999965	15	5
56	44	8.107167	11.892833	8.107202	11.892797	10.000036	9.999964	16	4
57	15	8.109627	11.890373	8.109663	11.890337	10.000036	9.999964	45	3
58	30	8.112074	11.887926	8.112110	11.887890	10.000036	9.999964	30	2
59	45	8.114507	11.885493	8.114544	11.885456	10.000037	9.999963	15	1
60	45	8.116926	11.883074	8.116963	11.883037	10.000037	9.999963	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

5^h 57^m.

LOG. SINES, &c.

89 deg.

0 ^h 3 ^m			LOG. SINES, &c. (t)						0 ^o deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0	45		8.116926	11.883074	8.116965	11.883037	10.000037	9.999963	15		60
1		15	8.119332	11.880668	8.119370	11.880630	10.000038	9.999962	45		59
2		30	8.121725	11.878275	8.121763	11.878237	10.000038	9.999962	30		58
3		45	8.124104	11.875896	8.124143	11.875857	10.000039	9.999961	15		57
4	46		8.126471	11.873529	8.126510	11.873490	10.000039	9.999961	14		56
5		15	8.128825	11.871175	8.128864	11.871136	10.000039	9.999961	45		55
6		30	8.131166	11.868834	8.131206	11.868794	10.000040	9.999960	30		54
7		45	8.133494	11.866506	8.133534	11.866465	10.000040	9.999960	15		53
8	47		8.135810	11.864190	8.135851	11.864149	10.000041	9.999959	13		52
9		15	8.138114	11.861886	8.138155	11.861845	10.000041	9.999959	45		51
10		30	8.140406	11.859593	8.140447	11.859553	10.000042	9.999959	30		50
11		45	8.142685	11.857315	8.142727	11.857273	10.000042	9.999958	15		49
12	48		8.144953	11.855047	8.144996	11.855004	10.000042	9.999958	12		48
13		15	8.147209	11.852791	8.147252	11.852748	10.000043	9.999957	45		47
14		30	8.149453	11.850547	8.149497	11.850503	10.000043	9.999957	30		46
15		45	8.151686	11.848314	8.151730	11.848270	10.000044	9.999956	15		45
16	49		8.153907	11.846093	8.153952	11.846048	10.000044	9.999956	11		44
17		15	8.156117	11.843883	8.156162	11.843838	10.000045	9.999955	45		43
18		30	8.158316	11.841684	8.158361	11.841639	10.000045	9.999955	30		42
19		45	8.160504	11.839496	8.160549	11.839450	10.000046	9.999954	15		41
20	50		8.162681	11.837319	8.162727	11.837273	10.000046	9.999954	10		40
21		15	8.164847	11.835153	8.164893	11.835107	10.000046	9.999954	45		39
22		30	8.167002	11.832998	8.167049	11.832951	10.000047	9.999953	30		38
23		45	8.169146	11.830854	8.169194	11.830806	10.000047	9.999953	15		37
24	51		8.171280	11.828720	8.171328	11.828672	10.000048	9.999952	9		36
25		15	8.173404	11.826596	8.173452	11.826548	10.000048	9.999952	45		35
26		30	8.175517	11.824483	8.175566	11.824434	10.000049	9.999951	30		34
27		45	8.177620	11.822380	8.177669	11.822331	10.000049	9.999951	15		33
28	52		8.179713	11.820287	8.179763	11.820237	10.000050	9.999950	8		32
29		15	8.181796	11.818204	8.181846	11.818154	10.000050	9.999950	45		31
30		30	8.183868	11.816132	8.183919	11.816081	10.000051	9.999949	30		30
31		45	8.185931	11.814069	8.185983	11.814017	10.000051	9.999949	15		29
32	53		8.187985	11.812015	8.188036	11.811964	10.000052	9.999948	7		28
33		15	8.190028	11.809972	8.190080	11.809919	10.000052	9.999948	45		27
34		30	8.192062	11.807938	8.192115	11.807885	10.000053	9.999947	30		26
35		45	8.194087	11.805913	8.194140	11.805860	10.000053	9.999947	15		25
36	54		8.196102	11.803898	8.196156	11.803844	10.000054	9.999946	6		24
37		15	8.198108	11.801892	8.198162	11.801838	10.000054	9.999946	45		23
38		30	8.200104	11.799896	8.200159	11.799841	10.000055	9.999945	30		22
39		45	8.202092	11.797908	8.202147	11.797853	10.000055	9.999945	15		21
40	55		8.204070	11.795930	8.204126	11.795874	10.000056	9.999944	5		20
41		15	8.206040	11.793960	8.206096	11.793904	10.000056	9.999944	45		19
42		30	8.208000	11.792000	8.208057	11.791943	10.000057	9.999943	30		18
43		45	8.209952	11.790048	8.210009	11.789991	10.000057	9.999943	15		17
44	56		8.211895	11.788105	8.211953	11.788047	10.000058	9.999942	4		16
45		15	8.213829	11.786171	8.213887	11.786113	10.000058	9.999942	45		15
46		30	8.215755	11.784245	8.215814	11.784186	10.000059	9.999941	30		14
47		45	8.217672	11.782328	8.217731	11.782269	10.000059	9.999941	15		13
48	57		8.219581	11.780419	8.219641	11.780359	10.000060	9.999940	3		12
49		15	8.221481	11.778519	8.221542	11.778458	10.000060	9.999940	45		11
50		30	8.223374	11.776626	8.223434	11.776565	10.000061	9.999939	30		10
51		45	8.225258	11.774742	8.225319	11.774681	10.000061	9.999939	15		9
52	58		8.227133	11.772867	8.227195	11.772805	10.000062	9.999938	2		8
53		15	8.229001	11.770999	8.229064	11.770936	10.000062	9.999938	45		7
54		30	8.230861	11.769139	8.230924	11.769076	10.000063	9.999937	30		6
55		45	8.232713	11.767287	8.232776	11.767224	10.000063	9.999937	15		5
56	59		8.234557	11.765443	8.234621	11.765379	10.000064	9.999936	1		4
57		15	8.236393	11.763607	8.236457	11.763542	10.000065	9.999935	45		3
58		30	8.238221	11.761779	8.238286	11.761713	10.000065	9.999935	30		2
59		45	8.240042	11.759958	8.240108	11.759892	10.000066	9.999934	15		1
60	60		8.241855	11.758145	8.241921	11.758078	10.000066	9.999934	0		0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.
5 ^h 56 ^m			LOG SINES, &c.						89 deg.		

0 ^h 4 ^m		LOG. SINES, &c. (t)						1 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	0	8.241855	11.758145	8.241921	11.758079	10.000066	9.999934		60	60
1	15	8.243661	11.756339	8.243728	11.756272	10.000067	9.999933	45		59
2	30	8.245459	11.754541	8.245526	11.754474	10.000067	9.999933	30		58
3	45	8.247250	11.752750	8.247318	11.752682	10.000068	9.999932	15		57
4	1	8.249033	11.750967	8.249101	11.750899	10.000068	9.999932		59	56
5	15	8.250809	11.749191	8.250878	11.749122	10.000069	9.999931	45		55
6	30	8.252578	11.747422	8.252648	11.747352	10.000070	9.999930	30		54
7	45	8.254340	11.745660	8.254410	11.745590	10.000070	9.999930	15		53
8	2	8.256094	11.743906	8.256165	11.743835	10.000071	9.999929		58	52
9	15	8.257842	11.742158	8.257913	11.742087	10.000071	9.999929	45		51
10	30	8.259582	11.740418	8.259654	11.740346	10.000072	9.999928	30		50
11	45	8.261316	11.738684	8.261388	11.738612	10.000072	9.999928	15		49
12	3	8.263042	11.736958	8.263115	11.736885	10.000073	9.999927		57	48
13	15	8.264762	11.735238	8.264836	11.735164	10.000074	9.999926	45		47
14	30	8.266475	11.733525	8.266549	11.733451	10.000074	9.999926	30		46
15	45	8.268181	11.731819	8.268256	11.731744	10.000075	9.999925	15		45
16	4	8.269881	11.730119	8.269956	11.730044	10.000075	9.999925		56	44
17	15	8.271574	11.728426	8.271650	11.728350	10.000076	9.999924	45		43
18	30	8.273260	11.726740	8.273337	11.726663	10.000076	9.999924	30		42
19	45	8.274940	11.725060	8.275017	11.724983	10.000077	9.999923	15		41
20	5	8.276614	11.723386	8.276691	11.723309	10.000078	9.999922		55	40
21	15	8.278281	11.721719	8.278359	11.721641	10.000078	9.999922	45		39
22	30	8.279941	11.720059	8.280020	11.719980	10.000079	9.999921	30		38
23	45	8.281595	11.718405	8.281675	11.718325	10.000080	9.999921	15		37
24	6	8.283243	11.716757	8.283323	11.716677	10.000080	9.999920		54	36
25	15	8.284885	11.715115	8.284966	11.715034	10.000081	9.999919	45		35
26	30	8.286521	11.713479	8.286602	11.713398	10.000081	9.999919	30		34
27	45	8.288150	11.711850	8.288232	11.711768	10.000082	9.999918	15		33
28	7	8.289773	11.710227	8.289856	11.710144	10.000083	9.999917		53	32
29	15	8.291391	11.708609	8.291474	11.708526	10.000083	9.999917	45		31
30	30	8.293002	11.706998	8.293086	11.706914	10.000084	9.999916	30		30
31	45	8.294607	11.705393	8.294692	11.705309	10.000084	9.999916	15		29
32	8	8.296207	11.703793	8.296292	11.703708	10.000085	9.999915		52	28
33	15	8.297800	11.702200	8.297886	11.702114	10.000086	9.999914	45		27
34	30	8.299388	11.700612	8.299474	11.700526	10.000086	9.999914	30		26
35	45	8.300970	11.699030	8.301057	11.698943	10.000087	9.999913	15		25
36	9	8.302546	11.697454	8.302633	11.697367	10.000088	9.999912		51	24
37	15	8.304116	11.695884	8.304205	11.695795	10.000088	9.999912	45		23
38	30	8.305681	11.694319	8.305770	11.694230	10.000089	9.999911	30		22
39	45	8.307240	11.692760	8.307330	11.692670	10.000090	9.999911	15		21
40	10	8.308794	11.691206	8.308884	11.691116	10.000090	9.999910		50	20
41	15	8.310342	11.689658	8.310433	11.689567	10.000091	9.999909	45		19
42	30	8.311885	11.688115	8.311976	11.688024	10.000091	9.999909	30		18
43	45	8.313422	11.686578	8.313514	11.686486	10.000092	9.999908	15		17
44	11	8.314954	11.685046	8.315046	11.684954	10.000093	9.999907		49	16
45	15	8.316480	11.683520	8.316573	11.683427	10.000093	9.999907	45		15
46	30	8.318001	11.681999	8.318095	11.681905	10.000094	9.999906	30		14
47	45	8.319516	11.680484	8.319611	11.680389	10.000095	9.999905	15		13
48	12	8.321027	11.678973	8.321122	11.678878	10.000095	9.999905		48	12
49	15	8.322532	11.677468	8.322628	11.677372	10.000096	9.999904	45		11
50	30	8.324032	11.675968	8.324128	11.675872	10.000097	9.999903	30		10
51	45	8.325527	11.674473	8.325624	11.674376	10.000097	9.999903	15		9
52	13	8.327016	11.672984	8.327114	11.672886	10.000098	9.999902		47	8
53	15	8.328501	11.671499	8.328599	11.671400	10.000099	9.999901	45		7
54	30	8.329980	11.670020	8.330080	11.669920	10.000099	9.999901	30		6
55	45	8.331455	11.668545	8.331555	11.668445	10.000100	9.999900	15		5
56	14	8.332924	11.667076	8.333025	11.666975	10.000101	9.999899		46	4
57	15	8.334389	11.665611	8.334490	11.665510	10.000101	9.999899	45		3
58	30	8.335848	11.664152	8.335950	11.664050	10.000102	9.999898	30		2
59	45	8.337303	11.662697	8.337406	11.662594	10.000103	9.999897	15		1
60	15	8.338753	11.661247	8.338856	11.661144	10.000103	9.999897		45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	'	sec.
5 ^h 55 ^m		LOG. SINES, &c.						88 deg.		

0 ^h 5 ^m .		LOG. SINES, &c. (t)						1 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	s. s.
0	15	8.338753	11.661247	8.338856	11.661144	10.000103	9.999897	45	60
1	15	8.340198	11.659802	8.340302	11.659698	10.000104	9.999896	45	59
2	30	8.341638	11.658362	8.341743	11.658257	10.000105	9.999895	30	58
3	45	8.343074	11.656926	8.343179	11.656821	10.000105	9.999895	15	57
4	16	8.344504	11.655496	8.344610	11.655390	10.000106	9.999894	44	56
5	15	8.345930	11.654070	8.346037	11.653963	10.000107	9.999893	45	55
6	30	8.347352	11.652648	8.347459	11.652541	10.000108	9.999892	30	54
7	45	8.348768	11.651232	8.348877	11.651123	10.000108	9.999892	15	53
8	17	8.350180	11.649820	8.350289	11.649711	10.000109	9.999891	43	52
9	15	8.351588	11.648412	8.351698	11.648302	10.000110	9.999890	45	51
10	30	8.352991	11.647009	8.353101	11.646899	10.000110	9.999890	30	50
11	45	8.354389	11.645611	8.354501	11.645499	10.000111	9.999889	15	49
12	18	8.355783	11.644217	8.355895	11.644105	10.000112	9.999888	42	48
13	15	8.357173	11.642827	8.357285	11.642715	10.000113	9.999887	45	47
14	30	8.358558	11.641442	8.358671	11.641329	10.000113	9.999887	30	46
15	45	8.359939	11.640061	8.360053	11.639947	10.000114	9.999886	15	45
16	19	8.361315	11.638685	8.361430	11.638570	10.000115	9.999885	41	44
17	15	8.362687	11.637313	8.362802	11.637198	10.000115	9.999885	45	43
18	30	8.364054	11.635946	8.364171	11.635829	10.000116	9.999884	30	42
19	45	8.365418	11.634582	8.365535	11.634465	10.000117	9.999883	15	41
20	20	8.366777	11.633223	8.366894	11.633106	10.000118	9.999882	40	40
21	15	8.368132	11.631868	8.368250	11.631750	10.000118	9.999882	45	39
22	30	8.369482	11.630518	8.369601	11.630399	10.000119	9.999881	30	38
23	45	8.370829	11.629171	8.370948	11.629052	10.000120	9.999880	15	37
24	21	8.372171	11.627829	8.372291	11.627709	10.000121	9.999879	39	36
25	15	8.373509	11.626491	8.373630	11.626370	10.000121	9.999879	45	35
26	30	8.374843	11.625157	8.374965	11.625035	10.000122	9.999878	30	34
27	45	8.376173	11.623827	8.376296	11.623704	10.000123	9.999877	15	33
28	22	8.377499	11.622501	8.377622	11.622378	10.000124	9.999876	38	32
29	15	8.378821	11.621179	8.378945	11.621055	10.000124	9.999876	45	31
30	30	8.380138	11.619862	8.380263	11.619737	10.000125	9.999875	30	30
31	45	8.381452	11.618548	8.381578	11.618422	10.000126	9.999874	15	29
32	23	8.382762	11.617238	8.382889	11.617111	10.000127	9.999873	37	28
33	15	8.384068	11.615932	8.384195	11.615805	10.000127	9.999873	45	27
34	30	8.385370	11.614630	8.385498	11.614502	10.000128	9.999872	30	26
35	45	8.386668	11.613332	8.386797	11.613203	10.000129	9.999871	15	25
36	24	8.387962	11.612038	8.388092	11.611908	10.000130	9.999870	36	24
37	15	8.389253	11.610747	8.389383	11.610617	10.000130	9.999870	45	23
38	30	8.390539	11.609461	8.390670	11.609330	10.000131	9.999869	30	22
39	45	8.391822	11.608178	8.391954	11.608046	10.000132	9.999868	15	21
40	25	8.393101	11.606899	8.393234	11.606766	10.000133	9.999867	35	20
41	15	8.394376	11.605624	8.394509	11.605491	10.000134	9.999866	45	19
42	30	8.395647	11.604353	8.395782	11.604218	10.000134	9.999866	30	18
43	45	8.396915	11.603085	8.397050	11.602950	10.000135	9.999865	15	17
44	26	8.398179	11.601821	8.398315	11.601685	10.000136	9.999864	34	16
45	15	8.399440	11.600560	8.399576	11.600424	10.000137	9.999863	45	15
46	30	8.400696	11.599304	8.400834	11.599166	10.000138	9.999862	30	14
47	45	8.401949	11.598051	8.402088	11.597912	10.000138	9.999862	15	13
48	27	8.403199	11.596801	8.403338	11.596662	10.000139	9.999861	33	12
49	15	8.404445	11.595555	8.404585	11.595415	10.000140	9.999860	45	11
50	30	8.405687	11.594313	8.405828	11.594172	10.000141	9.999859	30	10
51	45	8.406926	11.593074	8.407068	11.592932	10.000142	9.999858	15	9
52	28	8.408161	11.591839	8.408304	11.591696	10.000142	9.999858	32	8
53	15	8.409393	11.590607	8.409536	11.590464	10.000143	9.999857	45	7
54	30	8.410621	11.589379	8.410765	11.589235	10.000144	9.999856	30	6
55	45	8.411846	11.588154	8.411991	11.588009	10.000145	9.999855	15	5
56	29	8.413068	11.586932	8.413213	11.586787	10.000146	9.999854	31	4
57	15	8.414286	11.585714	8.414432	11.585568	10.000146	9.999854	45	3
58	30	8.415500	11.584500	8.415647	11.584353	10.000147	9.999853	30	2
59	45	8.416711	11.583289	8.416859	11.583141	10.000148	9.999852	15	1
60	30	8.417919	11.582081	8.418068	11.581932	10.000149	9.999851	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 54 ^m .		LOG. SINES, &c.						58 deg.	

0 ^h 6 ^m .			LOG. SINES, &c. (t.)						1 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.	
0	30	8.417919	11.582081	8.418068	11.581932	10.000149	9.999851	30		60	
1	15	8.419123	11.580877	8.419273	11.580727	10.000150	9.999850	45		59	
2	30	8.420324	11.579676	8.420475	11.579525	10.000151	9.999849	30		58	
3	45	8.421522	11.578478	8.421674	11.578326	10.000151	9.999849	15		57	
4	31	8.422717	11.577283	8.422869	11.577131	10.000152	9.999848		29	56	
5	15	8.423908	11.576092	8.424061	11.575939	10.000153	9.999847	45		55	
6	30	8.425096	11.574904	8.425250	11.574750	10.000154	9.999846	30		54	
7	45	8.426281	11.573719	8.426435	11.573565	10.000155	9.999845	15		53	
8	32	8.427462	11.572538	8.427618	11.572382	10.000156	9.999844		28	52	
9	15	8.428640	11.571360	8.428797	11.571203	10.000156	9.999844	45		51	
10	30	8.429815	11.570185	8.429973	11.570027	10.000157	9.999843	30		50	
11	45	8.430987	11.569013	8.431145	11.568855	10.000158	9.999842	15		49	
12	33	8.432156	11.567844	8.432315	11.567685	10.000159	9.999841		27	48	
13	15	8.433322	11.566678	8.433481	11.566519	10.000160	9.999840	45		47	
14	30	8.434484	11.565516	8.434645	11.565355	10.000161	9.999839	30		46	
15	45	8.435644	11.564356	8.435805	11.564195	10.000162	9.999838	15		45	
16	34	8.436800	11.563200	8.436962	11.563038	10.000162	9.999838		26	44	
17	15	8.437953	11.562047	8.438116	11.561884	10.000163	9.999837	45		43	
18	30	8.439103	11.560897	8.439267	11.560733	10.000164	9.999836	30		42	
19	45	8.440250	11.559750	8.440415	11.559585	10.000165	9.999835	15		41	
20	35	8.441394	11.558606	8.441560	11.558440	10.000166	9.999834		25	40	
21	15	8.442535	11.557465	8.442702	11.557298	10.000167	9.999833	45		39	
22	30	8.443674	11.556326	8.443841	11.556159	10.000168	9.999832	30		38	
23	45	8.444809	11.555191	8.444977	11.555023	10.000169	9.999831	15		37	
24	36	8.445941	11.554059	8.446110	11.553890	10.000169	9.999831		24	36	
25	15	8.447070	11.552930	8.447240	11.552760	10.000170	9.999830	45		35	
26	30	8.448196	11.551804	8.448367	11.551633	10.000171	9.999829	30		34	
27	45	8.449320	11.550680	8.449492	11.550508	10.000172	9.999828	15		33	
28	37	8.450440	11.549560	8.450613	11.549387	10.000173	9.999827		23	32	
29	15	8.451558	11.548442	8.451732	11.548268	10.000174	9.999826	45		31	
30	30	8.452672	11.547328	8.452847	11.547153	10.000175	9.999825	30		30	
31	45	8.453784	11.546216	8.453960	11.546040	10.000176	9.999824	15		29	
32	38	8.454893	11.545107	8.455070	11.544930	10.000177	9.999823		22	28	
33	15	8.456000	11.544000	8.456177	11.543823	10.000177	9.999823	45		27	
34	30	8.457103	11.542897	8.457281	11.542719	10.000178	9.999822	30		26	
35	45	8.458203	11.541797	8.458383	11.541617	10.000179	9.999821	15		25	
36	39	8.459301	11.540699	8.459481	11.540519	10.000180	9.999820		21	24	
37	15	8.460396	11.539604	8.460577	11.539423	10.000181	9.999819	45		23	
38	30	8.461489	11.538511	8.461670	11.538330	10.000182	9.999818	30		22	
39	45	8.462578	11.537422	8.462761	11.537239	10.000183	9.999817	15		21	
40	40	8.463665	11.536335	8.463849	11.536151	10.000184	9.999816		20	20	
41	15	8.464749	11.535251	8.464934	11.535066	10.000185	9.999815	45		19	
42	30	8.465830	11.534170	8.466016	11.533984	10.000186	9.999814	30		18	
43	45	8.466909	11.533091	8.467095	11.532905	10.000187	9.999813	15		17	
44	41	8.467985	11.532015	8.468172	11.531828	10.000188	9.999812		19	16	
45	15	8.469058	11.530942	8.469247	11.530753	10.000188	9.999812	45		15	
46	30	8.470129	11.529871	8.470318	11.529682	10.000189	9.999811	30		14	
47	45	8.471197	11.528803	8.471387	11.528613	10.000190	9.999810	15		13	
48	42	8.472263	11.527737	8.472454	11.527546	10.000191	9.999809		18	12	
49	15	8.473325	11.526675	8.473517	11.526483	10.000192	9.999808	45		11	
50	30	8.474386	11.525614	8.474579	11.525421	10.000193	9.999807	30		10	
51	45	8.475443	11.524557	8.475637	11.524363	10.000194	9.999806	15		9	
52	43	8.476498	11.523502	8.476693	11.523307	10.000195	9.999805		17	8	
53	15	8.477551	11.522449	8.477747	11.522253	10.000196	9.999804	45		7	
54	30	8.478601	11.521399	8.478798	11.521202	10.000197	9.999803	30		6	
55	45	8.479648	11.520352	8.479846	11.520154	10.000198	9.999802	15		5	
56	44	8.480693	11.519307	8.480892	11.519108	10.000199	9.999801		16	4	
57	15	8.481736	11.518264	8.481935	11.518065	10.000200	9.999800	45		3	
58	30	8.482775	11.517225	8.482976	11.517024	10.000201	9.999799	30		2	
59	45	8.483813	11.516187	8.484015	11.515985	10.000202	9.999798	15		1	
60	45	8.484848	11.515152	8.485050	11.514950	10.000203	9.999797		15	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.	
5 ^h 53 ^m .			LOG. SINES, &c.				88 deg.				

0 ^h 7 ^m .		LOG. SINES, &c. (t)						1 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	8.484848	11.515152	8.485050	11.514950	10.000203	9.999797	15	60
1	15	8.485880	11.514120	8.486084	11.513916	10.000204	9.999796	45	50
2	30	8.486910	11.513090	8.487115	11.512885	10.000205	9.999795	30	54
3	45	8.487938	11.512062	8.488143	11.511857	10.000206	9.999794	15	57
4	46	8.488963	11.511037	8.489170	11.510830	10.000207	9.999793	14	56
5	15	8.489986	11.510014	8.490193	11.509807	10.000208	9.999792	45	55
6	30	8.491006	11.508994	8.491215	11.508785	10.000208	9.999792	30	54
7	45	8.492024	11.507976	8.492234	11.507766	10.000209	9.999791	15	53
8	47	8.493040	11.506960	8.493250	11.506750	10.000210	9.999790	13	52
9	15	8.494053	11.505947	8.494264	11.505736	10.000211	9.999789	45	51
10	30	8.495064	11.504936	8.495276	11.504724	10.000212	9.999788	30	50
11	45	8.496072	11.503928	8.496286	11.503714	10.000213	9.999787	15	49
12	48	8.497078	11.502922	8.497293	11.502707	10.000214	9.999786	12	48
13	15	8.498082	11.501918	8.498298	11.501702	10.000215	9.999785	45	47
14	30	8.499084	11.500916	8.499300	11.500700	10.000216	9.999784	30	46
15	45	8.500083	11.499917	8.500300	11.499700	10.000217	9.999783	15	45
16	49	8.501080	11.499200	8.501298	11.498702	10.000218	9.999782	11	44
17	15	8.502074	11.497926	8.502294	11.497706	10.000219	9.999781	45	43
18	30	8.503067	11.496933	8.503287	11.496713	10.000220	9.999780	30	42
19	45	8.504057	11.495943	8.504278	11.495722	10.000221	9.999779	15	41
20	50	8.505045	11.494955	8.505267	11.494733	10.000222	9.999778	10	40
21	15	8.506030	11.493970	8.506254	11.493746	10.000223	9.999777	45	39
22	30	8.507014	11.492986	8.507238	11.492762	10.000224	9.999776	30	38
23	45	8.507995	11.492005	8.508220	11.491780	10.000225	9.999775	15	37
24	51	8.508974	11.491026	8.509200	11.490800	10.000226	9.999774	9	36
25	15	8.509950	11.490050	8.510178	11.489822	10.000227	9.999773	45	35
26	30	8.510925	11.489075	8.511153	11.488847	10.000229	9.999771	30	34
27	45	8.511897	11.488103	8.512127	11.487873	10.000230	9.999770	15	33
28	52	8.512867	11.487133	8.513098	11.486902	10.000231	9.999769	8	32
29	15	8.513835	11.486165	8.514067	11.485933	10.000232	9.999768	45	31
30	30	8.514801	11.485199	8.515034	11.484966	10.000233	9.999767	30	30
31	45	8.515765	11.484235	8.515998	11.484002	10.000234	9.999766	15	29
32	53	8.516726	11.483274	8.516961	11.483039	10.000235	9.999765	7	28
33	15	8.517686	11.482314	8.517921	11.482079	10.000236	9.999764	45	27
34	30	8.518643	11.481357	8.518880	11.481120	10.000237	9.999763	30	26
35	45	8.519598	11.480402	8.519836	11.480164	10.000238	9.999762	15	25
36	54	8.520551	11.479449	8.520790	11.479210	10.000239	9.999761	6	24
37	15	8.521502	11.478498	8.521742	11.478258	10.000240	9.999760	45	23
38	30	8.522451	11.477549	8.522692	11.477308	10.000241	9.999759	30	22
39	45	8.523398	11.476602	8.523640	11.476360	10.000242	9.999758	15	21
40	55	8.524343	11.475657	8.524586	11.475414	10.000243	9.999757	5	20
41	15	8.525286	11.474714	8.525530	11.474470	10.000244	9.999756	45	19
42	30	8.526226	11.473774	8.526472	11.473528	10.000245	9.999755	30	18
43	45	8.527165	11.472835	8.527411	11.472589	10.000246	9.999754	15	17
44	56	8.528102	11.471898	8.528349	11.471651	10.000247	9.999753	4	16
45	15	8.529036	11.470964	8.529285	11.470715	10.000248	9.999752	45	15
46	30	8.529969	11.470031	8.530218	11.469782	10.000249	9.999751	30	14
47	45	8.530899	11.469101	8.531150	11.468850	10.000251	9.999749	15	13
48	57	8.531828	11.468172	8.532080	11.467920	10.000252	9.999748	3	12
49	15	8.532755	11.467245	8.533007	11.466993	10.000253	9.999747	45	11
50	30	8.533679	11.466321	8.533933	11.466067	10.000254	9.999746	30	10
51	45	8.534602	11.465398	8.534857	11.465143	10.000255	9.999745	15	9
52	58	8.535523	11.464477	8.535779	11.464221	10.000256	9.999744	2	8
53	15	8.536442	11.463558	8.536699	11.463301	10.000257	9.999743	45	7
54	30	8.537358	11.462642	8.537616	11.462384	10.000258	9.999742	30	6
55	45	8.538273	11.461727	8.538532	11.461468	10.000259	9.999741	15	5
56	59	8.539186	11.460814	8.539447	11.460553	10.000260	9.999740	1	4
57	15	8.540097	11.459903	8.540359	11.459641	10.000261	9.999739	45	3
58	30	8.541007	11.458993	8.541269	11.458731	10.000262	9.999738	30	2
59	45	8.541914	11.458086	8.542177	11.457823	10.000264	9.999736	15	1
60	60	8.542819	11.457181	8.543084	11.456916	10.000265	9.999735	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
5 ^h 52 ^m .		LOG SINES, &c.						88 deg.	

0 ^h 5 ^m .		LOG. SINES, &c. (t.)						2 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	0	8.542819	11.457181	8.543084	11.456916	10.000265	9.999735	60		60
1	15	8.543723	11.456277	8.543988	11.456012	10.000266	9.999734	45		59
2	30	8.544624	11.455376	8.544891	11.455109	10.000267	9.999733	30		58
3	45	8.545524	11.454476	8.545792	11.454208	10.000268	9.999732	15		57
4	1	8.546422	11.453578	8.546691	11.453309	10.000269	9.999731	59		56
5	15	8.547318	11.452682	8.547588	11.452412	10.000270	9.999730	45		55
6	30	8.548212	11.451788	8.548483	11.451517	10.000271	9.999729	30		54
7	45	8.549104	11.450896	8.549377	11.450623	10.000272	9.999728	15		53
8	2	8.549995	11.450005	8.550268	11.449732	10.000274	9.999726	58		52
9	15	8.550883	11.449117	8.551158	11.448842	10.000275	9.999725	45		51
10	30	8.551770	11.448220	8.552046	11.447954	10.000276	9.999724	30		50
11	45	8.552655	11.447345	8.552932	11.447068	10.000277	9.999723	15		49
12	3	8.553539	11.446461	8.553817	11.446183	10.000278	9.999722	57		48
13	15	8.554420	11.445580	8.554699	11.445301	10.000279	9.999721	45		47
14	30	8.555300	11.444700	8.555580	11.444420	10.000280	9.999720	30		46
15	45	8.556177	11.443823	8.556459	11.443541	10.000281	9.999719	15		45
16	4	8.557054	11.442946	8.557336	11.442664	10.000283	9.999717	56		44
17	15	8.557928	11.442072	8.558212	11.441788	10.000284	9.999716	45		43
18	30	8.558800	11.441200	8.559085	11.440915	10.000285	9.999715	30		42
19	45	8.559671	11.440329	8.559957	11.440043	10.000286	9.999714	15		41
20	5	8.560540	11.439460	8.560828	11.439172	10.000287	9.999713	55		40
21	15	8.561408	11.438592	8.561696	11.438304	10.000288	9.999712	45		39
22	30	8.562273	11.437727	8.562563	11.437437	10.000290	9.999710	30		38
23	45	8.563137	11.436863	8.563428	11.436572	10.000291	9.999709	15		37
24	6	8.563999	11.436001	8.564291	11.435709	10.000292	9.999708	54		36
25	15	8.564860	11.435140	8.565153	11.434847	10.000293	9.999707	45		35
26	30	8.565719	11.434281	8.566013	11.433987	10.000294	9.999706	30		34
27	45	8.566576	11.433424	8.566871	11.433129	10.000295	9.999705	15		33
28	7	8.567431	11.432569	8.567727	11.432273	10.000296	9.999704	53		32
29	15	8.568285	11.431715	8.568582	11.431418	10.000298	9.999702	45		31
30	30	8.569137	11.430863	8.569435	11.430565	10.000299	9.999701	30		30
31	45	8.569987	11.430013	8.570287	11.429713	10.000300	9.999700	15		29
32	8	8.570836	11.429164	8.571137	11.428863	10.000301	9.999699	52		28
33	15	8.571683	11.428317	8.571985	11.428015	10.000302	9.999698	45		27
34	30	8.572528	11.427472	8.572832	11.427168	10.000304	9.999696	30		26
35	45	8.573372	11.426628	8.573676	11.426324	10.000305	9.999695	15		25
36	9	8.574214	11.425786	8.574520	11.425480	10.000306	9.999694	51		24
37	15	8.575054	11.424946	8.575361	11.424639	10.000307	9.999693	45		23
38	30	8.575893	11.424107	8.576201	11.423799	10.000308	9.999692	30		22
39	45	8.576730	11.423270	8.577040	11.422960	10.000309	9.999691	15		21
40	10	8.577566	11.422434	8.577877	11.422123	10.000311	9.999689	50		20
41	15	8.578400	11.421600	8.578712	11.421288	10.000312	9.999688	45		19
42	30	8.579232	11.420768	8.579545	11.420455	10.000313	9.999687	30		18
43	45	8.580063	11.419937	8.580377	11.419623	10.000314	9.999686	15		17
44	11	8.580892	11.419108	8.581208	11.418792	10.000315	9.999685	49		16
45	15	8.581720	11.418280	8.582036	11.417964	10.000317	9.999683	45		15
46	30	8.582546	11.417454	8.582864	11.417136	10.000318	9.999682	30		14
47	45	8.583370	11.416630	8.583689	11.416311	10.000319	9.999681	15		13
48	12	8.584193	11.415807	8.584514	11.415486	10.000320	9.999680	48		12
49	15	8.585015	11.414985	8.585336	11.414664	10.000321	9.999679	45		11
50	30	8.585834	11.414166	8.586157	11.413843	10.000323	9.999677	30		10
51	45	8.586653	11.413347	8.586976	11.413023	10.000324	9.999676	15		9
52	13	8.587469	11.412531	8.587794	11.412206	10.000325	9.999675	47		8
53	15	8.588285	11.411715	8.588611	11.411389	10.000326	9.999674	45		7
54	30	8.589098	11.410902	8.589426	11.410574	10.000328	9.999672	30		6
55	45	8.589910	11.410090	8.590239	11.409761	10.000329	9.999671	15		5
56	14	8.590721	11.409279	8.591051	11.408949	10.000330	9.999670	46		4
57	15	8.591530	11.408470	8.591861	11.408139	10.000331	9.999669	45		3
58	30	8.592338	11.407662	8.592670	11.407330	10.000333	9.999667	30		2
59	45	8.593144	11.406856	8.593477	11.406523	10.000334	9.999666	15		1
60	15	8.593948	11.406052	8.594283	11.405717	10.000335	9.999665	45		0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	"	sec.
5 ^h 51 ^m .		LOG. SINES, &c.						87 deg.		

0 ^h 9 ^m .		LOG. SINES, &c. (t.)						2 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	15	8.593948	11.406052	8.594283	11.405717	10.000335	9.999665	45	60	
1	15	8.594751	11.405249	8.595087	11.404913	10.000336	9.999664	45	59	
2	30	8.595553	11.404447	8.595890	11.404110	10.000337	9.999663	30	58	
3	45	8.596353	11.403647	8.596692	11.403308	10.000339	9.999661	15	57	
4	16	8.597152	11.402848	8.597492	11.402508	10.000340	9.999660	44	56	
5	15	8.597949	11.402051	8.598290	11.401710	10.000341	9.999659	45	55	
6	30	8.598745	11.401255	8.599087	11.401913	10.000342	9.999658	30	54	
7	45	8.599539	11.400461	8.599883	11.400117	10.000344	9.999656	15	53	
8	17	8.600332	11.399668	8.600677	11.399323	10.000345	9.999655	43	52	
9	15	8.601123	11.398877	8.601469	11.398531	10.000346	9.999654	45	51	
10	30	8.601913	11.398087	8.602260	11.397740	10.000348	9.999652	30	50	
11	45	8.602701	11.397299	8.603050	11.396950	10.000349	9.999651	15	49	
12	18	8.603489	11.396511	8.603839	11.396161	10.000350	9.999650	42	48	
13	15	8.604274	11.395726	8.604625	11.395374	10.000351	9.999649	45	47	
14	30	8.605058	11.394942	8.605411	11.394589	10.000353	9.999647	30	46	
15	45	8.605841	11.394159	8.606195	11.393805	10.000354	9.999646	15	45	
16	19	8.606623	11.393377	8.606978	11.393022	10.000355	9.999645	41	44	
17	15	8.607403	11.392597	8.607759	11.392241	10.000356	9.999644	45	43	
18	30	8.608181	11.391819	8.608539	11.391461	10.000358	9.999642	30	42	
19	45	8.608958	11.391042	8.609317	11.390683	10.000359	9.999641	15	41	
20	20	8.609734	11.390266	8.610094	11.389906	10.000360	9.999640	40	40	
21	15	8.610508	11.389492	8.610870	11.389130	10.000362	9.999638	45	39	
22	30	8.611281	11.388719	8.611644	11.388356	10.000363	9.999637	30	38	
23	45	8.612053	11.387947	8.612417	11.387583	10.000364	9.999636	15	37	
24	21	8.612823	11.387177	8.613189	11.386811	10.000365	9.999635	39	36	
25	15	8.613592	11.386408	8.613959	11.386041	10.000367	9.999633	45	35	
26	30	8.614360	11.385640	8.614728	11.385272	10.000368	9.999632	30	34	
27	45	8.615126	11.384874	8.615495	11.384505	10.000369	9.999631	15	33	
28	22	8.615891	11.384109	8.616262	11.383738	10.000371	9.999629	38	32	
29	15	8.616654	11.383346	8.617026	11.382974	10.000372	9.999628	45	31	
30	30	8.617417	11.382583	8.617790	11.382210	10.000373	9.999627	30	30	
31	45	8.618177	11.381823	8.618552	11.381448	10.000375	9.999625	15	29	
32	23	8.618937	11.381063	8.619313	11.380687	10.000376	9.999624	37	28	
33	15	8.619695	11.380305	8.620072	11.379928	10.000377	9.999623	45	27	
34	30	8.620452	11.379548	8.620830	11.379170	10.000379	9.999621	30	26	
35	45	8.621207	11.378793	8.621587	11.378413	10.000380	9.999620	15	25	
36	24	8.621962	11.378038	8.622343	11.377657	10.000381	9.999619	36	24	
37	15	8.622714	11.377285	8.623097	11.376903	10.000382	9.999618	45	23	
38	30	8.623466	11.376534	8.623850	11.376150	10.000384	9.999616	30	22	
39	45	8.624216	11.375784	8.624601	11.375399	10.000385	9.999615	15	21	
40	25	8.624965	11.375035	8.625352	11.374648	10.000386	9.999614	35	20	
41	15	8.625713	11.374287	8.626101	11.373899	10.000388	9.999612	45	19	
42	30	8.626459	11.373541	8.626848	11.373152	10.000389	9.999611	30	18	
43	45	8.627205	11.372795	8.627595	11.372405	10.000390	9.999610	15	17	
44	26	8.627948	11.372052	8.628340	11.371660	10.000392	9.999608	34	16	
45	15	8.628691	11.371309	8.629084	11.371916	10.000393	9.999607	45	15	
46	30	8.629432	11.370568	8.629827	11.370173	10.000395	9.999605	30	14	
47	45	8.630172	11.369828	8.630568	11.369432	10.000396	9.999604	15	13	
48	27	8.630911	11.369089	8.631308	11.368692	10.000397	9.999603	33	12	
49	15	8.631649	11.368351	8.632047	11.367953	10.000399	9.999601	45	11	
50	30	8.632385	11.367615	8.632785	11.367215	10.000400	9.999600	30	10	
51	45	8.633120	11.366880	8.633521	11.366479	10.000401	9.999599	15	9	
52	28	8.633854	11.366146	8.634256	11.365744	10.000403	9.999597	32	8	
53	15	8.634586	11.365414	8.634990	11.365010	10.000404	9.999596	45	7	
54	30	8.635317	11.364683	8.635723	11.364277	10.000405	9.999595	30	6	
55	45	8.636048	11.363952	8.636454	11.363546	10.000407	9.999593	15	5	
56	29	8.636776	11.363224	8.637184	11.362816	10.000408	9.999592	31	4	
57	15	8.637504	11.362496	8.637913	11.362087	10.000409	9.999591	45	3	
58	30	8.638230	11.361770	8.638641	11.361359	10.000411	9.999589	30	2	
59	45	8.638956	11.361044	8.639368	11.360632	10.000412	9.999588	15	1	
60	30	8.639680	11.360320	8.640093	11.359907	10.000414	9.999586	30	0	
sec.	"	co-sine.	secant.	cotangent.	tangent.	cosecant	sine.	"	sec.	
5 ^h 50 ^m .		LOG. SINES, &c.						87 deg.		

0 ^h 10 ^m .		LOG. SINES, &c. (t.)						2 deg.		
sec.	"	sine	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	30	8.639680	11.360320	8.640093	11.359907	10.000414	9.999586	30	60	
1	15	8.640402	11.359598	8.640817	11.359183	10.000415	9.999585	45	59	
2	30	8.641124	11.358876	8.641540	11.358460	10.000416	9.999584	30	58	
3	45	8.641844	11.358156	8.642262	11.357738	10.000418	9.999582	15	57	
4	31	8.642563	11.357437	8.642982	11.357018	10.000419	9.999581	29	56	
5	15	8.643281	11.356719	8.643702	11.356298	10.000421	9.999579	45	55	
6	30	8.643998	11.356002	8.644420	11.355580	10.000422	9.999578	30	54	
7	45	8.644714	11.355286	8.645137	11.354863	10.000423	9.999577	15	53	
8	32	8.645428	11.354572	8.645853	11.354147	10.000425	9.999575	28	52	
9	15	8.646141	11.353859	8.646567	11.353433	10.000426	9.999574	45	51	
10	30	8.646853	11.353147	8.647281	11.352719	10.000428	9.999572	30	50	
11	45	8.647564	11.352436	8.647993	11.352007	10.000429	9.999571	15	49	
12	33	8.648274	11.351726	8.648704	11.351296	10.000430	9.999570	27	48	
13	15	8.648983	11.351017	8.649414	11.350586	10.000432	9.999568	45	47	
14	30	8.649690	11.350310	8.650123	11.349877	10.000433	9.999567	30	46	
15	45	8.650396	11.349604	8.650831	11.349169	10.000435	9.999565	15	45	
16	34	8.651102	11.348898	8.651537	11.348463	10.000436	9.999564	26	44	
17	15	8.651806	11.348194	8.652243	11.347757	10.000437	9.999563	45	43	
18	30	8.652508	11.347492	8.652947	11.347053	10.000439	9.999561	30	42	
19	45	8.653210	11.346790	8.653650	11.346350	10.000440	9.999560	15	41	
20	35	8.653911	11.346089	8.654352	11.345648	10.000442	9.999558	25	40	
21	15	8.654610	11.345390	8.655053	11.344947	10.000443	9.999557	45	39	
22	30	8.655308	11.344692	8.655753	11.344247	10.000444	9.999556	30	38	
23	45	8.656006	11.343994	8.656451	11.343549	10.000446	9.999554	15	37	
24	36	8.656702	11.343298	8.657149	11.342851	10.000447	9.999553	24	36	
25	15	8.657397	11.342603	8.657845	11.342155	10.000449	9.999551	45	35	
26	30	8.658090	11.341910	8.658541	11.341459	10.000450	9.999550	30	34	
27	45	8.658783	11.341217	8.659235	11.340765	10.000452	9.999548	15	33	
28	37	8.659475	11.340525	8.659928	11.340072	10.000453	9.999547	23	32	
29	15	8.660165	11.339835	8.660620	11.339380	10.000455	9.999545	45	31	
30	30	8.660855	11.339145	8.661311	11.338689	10.000456	9.999544	30	30	
31	45	8.661543	11.338457	8.662000	11.338000	10.000457	9.999543	15	29	
32	38	8.662230	11.337770	8.662689	11.337311	10.000459	9.999541	22	28	
33	15	8.662916	11.337084	8.663377	11.336623	10.000460	9.999540	45	27	
34	30	8.663601	11.336399	8.664063	11.335937	10.000462	9.999538	30	26	
35	45	8.664285	11.335715	8.664749	11.335251	10.000463	9.999537	15	25	
36	39	8.664968	11.335032	8.665433	11.334567	10.000465	9.999535	21	24	
37	15	8.665650	11.334350	8.666116	11.333884	10.000466	9.999534	45	23	
38	30	8.666331	11.333669	8.666799	11.333201	10.000468	9.999532	30	22	
39	45	8.667011	11.332959	8.667480	11.332520	10.000469	9.999531	15	21	
40	40	8.667689	11.332311	8.668160	11.331840	10.000470	9.999530	20	20	
41	15	8.668367	11.331633	8.668839	11.331161	10.000472	9.999528	45	19	
42	30	8.669043	11.330957	8.669517	11.330483	10.000474	9.999526	30	18	
43	45	8.669719	11.330281	8.670194	11.329806	10.000475	9.999525	15	17	
44	41	8.670393	11.329607	8.670870	11.329130	10.000476	9.999524	19	16	
45	15	8.671067	11.328933	8.671544	11.328456	10.000478	9.999522	45	15	
46	30	8.671739	11.328261	8.672218	11.327782	10.000479	9.999521	30	14	
47	45	8.672410	11.327590	8.672891	11.327109	10.000481	9.999519	15	13	
48	42	8.673080	11.326920	8.673563	11.326437	10.000482	9.999518	18	12	
49	15	8.673750	11.326250	8.674233	11.325767	10.000484	9.999516	45	11	
50	30	8.674418	11.325582	8.674903	11.325097	10.000485	9.999515	30	10	
51	45	8.675085	11.324915	8.675572	11.324428	10.000487	9.999513	15	9	
52	43	8.675751	11.324249	8.676239	11.323761	10.000488	9.999512	17	8	
53	15	8.676416	11.323584	8.676906	11.323094	10.000490	9.999510	45	7	
54	30	8.677080	11.322920	8.677571	11.322429	10.000491	9.999509	30	6	
55	45	8.677743	11.322257	8.678236	11.321764	10.000493	9.999507	15	5	
56	44	8.678405	11.321595	8.678900	11.321100	10.000494	9.999506	16	4	
57	15	8.679066	11.320934	8.679562	11.320438	10.000496	9.999504	45	3	
58	30	8.679726	11.320274	8.680224	11.319776	10.000497	9.999503	30	2	
59	45	8.680385	11.319615	8.680884	11.319116	10.000499	9.999501	15	1	
60	45	8.681043	11.318957	8.681544	11.318456	10.000500	9.999500	15	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
5 ^h 49 ^m		LOG. SINES, &c.						87 deg.		

0 ^h 11 ^m .		LOG. SINES, &c. (t.)						2 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	8.681043	11.318957	8.681544	11.318456	10.000500	9.999500	15	60
1	15	8.681700	11.318300	8.682202	11.317798	10.000502	9.999498	45	59
2	30	8.682356	11.317644	8.682860	11.317140	10.000504	9.999496	30	58
3	45	8.683011	11.316989	8.683516	11.316484	10.000505	9.999495	15	57
4	46	8.683665	11.316335	8.684172	11.315828	10.000507	9.999493	14	56
5	15	8.684318	11.315682	8.684826	11.315174	10.000508	9.999492	45	55
6	30	8.684971	11.315029	8.685480	11.314520	10.000510	9.999490	30	54
7	45	8.685622	11.314378	8.686133	11.313867	10.000511	9.999489	15	53
8	47	8.686272	11.313728	8.686784	11.313216	10.000513	9.999487	13	52
9	15	8.686921	11.313079	8.687435	11.312565	10.000514	9.999486	45	51
10	30	8.687569	11.312431	8.688085	11.311915	10.000516	9.999484	30	50
11	45	8.688216	11.311784	8.688733	11.311267	10.000517	9.999483	15	49
12	48	8.688862	11.311138	8.689381	11.310619	10.000519	9.999481	12	48
13	15	8.689508	11.310492	8.690028	11.309972	10.000520	9.999480	45	47
14	30	8.690152	11.309848	8.690674	11.309326	10.000522	9.999478	30	46
15	45	8.690795	11.309205	8.691319	11.308681	10.000523	9.999477	15	45
16	49	8.691438	11.308562	8.691963	11.308037	10.000525	9.999475	11	44
17	15	8.692079	11.307921	8.692606	11.307394	10.000527	9.999473	45	43
18	30	8.692720	11.307280	8.693248	11.306752	10.000528	9.999472	30	42
19	45	8.693359	11.306641	8.693889	11.306111	10.000530	9.999470	15	41
20	50	8.693998	11.306002	8.694529	11.305471	10.000531	9.999469	10	40
21	15	8.694636	11.305364	8.695168	11.304832	10.000533	9.999467	45	39
22	30	8.695272	11.304728	8.695807	11.304193	10.000534	9.999466	30	38
23	45	8.695908	11.304092	8.696444	11.303556	10.000536	9.999464	15	37
24	51	8.696543	11.303457	8.697081	11.302919	10.000538	9.999462	9	36
25	15	8.697177	11.302823	8.697716	11.302284	10.000539	9.999461	45	35
26	30	8.697810	11.302190	8.698351	11.301649	10.000541	9.999459	30	34
27	45	8.698442	11.301558	8.698984	11.301016	10.000542	9.999458	15	33
28	52	8.699073	11.300927	8.699617	11.300383	10.000544	9.999456	8	32
29	15	8.699704	11.300296	8.700249	11.299751	10.000545	9.999455	45	31
30	30	8.700333	11.299667	8.700880	11.299120	10.000547	9.999453	30	30
31	45	8.700961	11.299039	8.701510	11.298490	10.000549	9.999451	15	29
32	53	8.701589	11.298411	8.702139	11.297861	10.000550	9.999450	7	28
33	15	8.702215	11.297785	8.702767	11.297233	10.000552	9.999448	45	27
34	30	8.702841	11.297159	8.703395	11.296605	10.000553	9.999447	30	26
35	45	8.703466	11.296534	8.704021	11.295979	10.000555	9.999445	15	25
36	54	8.704090	11.295910	8.704646	11.295354	10.000557	9.999443	6	24
37	15	8.704713	11.295287	8.705271	11.294729	10.000558	9.999442	45	23
38	30	8.705335	11.294665	8.705895	11.294105	10.000560	9.999440	30	22
39	45	8.705956	11.294044	8.706518	11.293482	10.000561	9.999439	15	21
40	55	8.706577	11.293423	8.707139	11.292861	10.000563	9.999437	5	20
41	15	8.707196	11.292804	8.707761	11.292239	10.000565	9.999435	45	19
42	30	8.707815	11.292185	8.708381	11.291619	10.000566	9.999434	30	18
43	45	8.708432	11.291568	8.709000	11.291000	10.000568	9.999432	15	17
44	56	8.709049	11.290951	8.709618	11.290382	10.000569	9.999431	4	16
45	15	8.709665	11.290335	8.710236	11.289764	10.000571	9.999429	45	15
46	30	8.710280	11.289720	8.710853	11.289147	10.000573	9.999427	30	14
47	45	8.710894	11.289106	8.711468	11.288532	10.000574	9.999426	15	13
48	57	8.711507	11.288493	8.712083	11.287917	10.000576	9.999424	3	12
49	15	8.712120	11.287880	8.712697	11.287303	10.000578	9.999422	45	11
50	30	8.712731	11.287269	8.713311	11.286689	10.000579	9.999421	30	10
51	45	8.713342	11.286658	8.713923	11.286077	10.000581	9.999419	15	9
52	58	8.713952	11.286048	8.714534	11.285466	10.000582	9.999418	2	8
53	15	8.714561	11.285439	8.715145	11.284855	10.000584	9.999416	45	7
54	30	8.715169	11.284831	8.715755	11.284245	10.000586	9.999414	30	6
55	45	8.715776	11.284224	8.716364	11.283636	10.000587	9.999413	15	5
56	59	8.716383	11.283617	8.716972	11.283028	10.000589	9.999411	1	4
57	15	8.716988	11.283012	8.717579	11.282421	10.000591	9.999409	45	3
58	30	8.717593	11.282407	8.718185	11.281815	10.000592	9.999408	30	2
59	45	8.718197	11.281803	8.718791	11.281209	10.000594	9.999406	15	1
60	60	8.718800	11.281200	8.719396	11.280604	10.000596	9.999404	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 48 ^m .		LOG. SINES, &c.						87 deg.	

0 ^h 12 ^m .		LOG. SINES, &c. (t.)						3 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	8.718800	11.281200	8.719396	11.280604	10.000596	9.999404	60	60
1	15	8.719402	11.280598	8.720000	11.280000	10.000597	9.999403	45	59
2	30	8.720004	11.279996	8.720603	11.279397	10.000599	9.999401	30	58
3	45	8.720604	11.279396	8.721205	11.278795	10.000601	9.999399	15	57
4	1	8.721204	11.278796	8.721806	11.278194	10.000602	9.999398	59	56
5	15	8.721803	11.278197	8.722407	11.277593	10.000604	9.999396	45	55
6	30	8.722401	11.277599	8.723006	11.276994	10.000606	9.999394	30	54
7	45	8.722998	11.277002	8.723605	11.276395	10.000607	9.999393	15	53
8	2	8.723595	11.276405	8.724203	11.275797	10.000609	9.999391	58	52
9	15	8.724190	11.275810	8.724801	11.275199	10.000611	9.999389	45	51
10	30	8.724785	11.275215	8.725397	11.274603	10.000612	9.999388	30	50
11	45	8.725379	11.274621	8.725993	11.274007	10.000614	9.999386	15	49
12	3	8.725972	11.274028	8.726588	11.273412	10.000616	9.999384	57	48
13	15	8.726564	11.273436	8.727182	11.272818	10.000617	9.999383	45	47
14	30	8.727156	11.272844	8.727775	11.272225	10.000619	9.999381	30	46
15	45	8.727747	11.272253	8.728367	11.271633	10.000621	9.999379	15	45
16	4	8.728337	11.271663	8.728959	11.271041	10.000622	9.999378	56	44
17	15	8.728926	11.271074	8.729550	11.270450	10.000624	9.999376	45	43
18	30	8.729514	11.270486	8.730140	11.269860	10.000626	9.999374	30	42
19	45	8.730101	11.269899	8.730729	11.269271	10.000628	9.999372	15	41
20	5	8.730688	11.269312	8.731317	11.268683	10.000629	9.999371	55	40
21	15	8.731274	11.268726	8.731905	11.268095	10.000631	9.999369	45	39
22	30	8.731859	11.268141	8.732492	11.267508	10.000633	9.999367	30	38
23	45	8.732444	11.267556	8.733078	11.266922	10.000634	9.999366	15	37
24	6	8.733027	11.266973	8.733663	11.266337	10.000636	9.999364	54	36
25	15	8.733610	11.266390	8.734248	11.265752	10.000638	9.999362	45	35
26	30	8.734192	11.265808	8.734831	11.265169	10.000639	9.999361	30	34
27	45	8.734773	11.265227	8.735414	11.264586	10.000641	9.999359	15	33
28	7	8.735353	11.264647	8.735996	11.264004	10.000643	9.999357	53	32
29	15	8.735933	11.264067	8.736578	11.263422	10.000645	9.999355	45	31
30	30	8.736512	11.263488	8.737158	11.262842	10.000646	9.999354	30	30
31	45	8.737090	11.262910	8.737738	11.262262	10.000648	9.999352	15	29
32	8	8.737667	11.262333	8.738317	11.261683	10.000650	9.999350	52	28
33	15	8.738244	11.261756	8.738895	11.261105	10.000652	9.999348	45	27
34	30	8.738820	11.261180	8.739473	11.260527	10.000653	9.999347	30	26
35	45	8.739395	11.260605	8.740050	11.259950	10.000655	9.999345	15	25
36	9	8.739969	11.260031	8.740626	11.259374	10.000657	9.999343	51	24
37	15	8.740543	11.259457	8.741201	11.258799	10.000658	9.999342	45	23
38	30	8.741115	11.258885	8.741775	11.258225	10.000660	9.999340	30	22
39	45	8.741687	11.258313	8.742349	11.257651	10.000662	9.999338	15	21
40	10	8.742259	11.257741	8.742922	11.257078	10.000664	9.999336	50	20
41	15	8.742829	11.257171	8.743494	11.256506	10.000665	9.999335	45	19
42	30	8.743399	11.256601	8.744066	11.255934	10.000667	9.999333	30	18
43	45	8.743968	11.256032	8.744637	11.255363	10.000669	9.999331	15	17
44	11	8.744536	11.255464	8.745207	11.254793	10.000671	9.999329	49	16
45	15	8.745103	11.254897	8.745776	11.254224	10.000672	9.999328	45	15
46	30	8.745670	11.254330	8.746344	11.253656	10.000674	9.999326	30	14
47	45	8.746236	11.253764	8.746912	11.253088	10.000676	9.999324	15	13
48	12	8.746801	11.253199	8.747479	11.252521	10.000678	9.999322	48	12
49	15	8.747366	11.252634	8.748045	11.251955	10.000680	9.999320	45	11
50	30	8.747930	11.252070	8.748611	11.251389	10.000681	9.999319	30	10
51	45	8.748493	11.251507	8.749176	11.250824	10.000683	9.999317	15	9
52	13	8.749055	11.250945	8.749740	11.250260	10.000685	9.999315	47	8
53	15	8.749617	11.250383	8.750303	11.249697	10.000687	9.999313	45	7
54	30	8.750178	11.249822	8.750866	11.249134	10.000688	9.999312	30	6
55	45	8.750738	11.249262	8.751428	11.248572	10.000690	9.999310	15	5
56	14	8.751297	11.248703	8.751989	11.248011	10.000692	9.999308	46	4
57	15	8.751856	11.248144	8.752550	11.247450	10.000694	9.999306	45	3
58	30	8.752414	11.247586	8.753109	11.246891	10.000696	9.999304	30	2
59	45	8.752971	11.247029	8.753668	11.246332	10.000697	9.999303	15	1
60	15	8.753528	11.246472	8.754227	11.245773	10.000699	9.999301	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 47 ^m .		LOG. SINES, &c.						56 deg.	

0 ^h 13 ^m .		LOG. SINES, &c. (t)						3 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	8.753528	11.246472	8.754227	11.245773	10.000699	9.999301	45	60
1	15	8.754084	11.245916	8.754784	11.245216	10.000701	9.999299	45	59
2	30	8.754639	11.245361	8.755341	11.244659	10.000703	9.999297	30	58
3	45	8.755193	11.244807	8.755898	11.244102	10.000704	9.999296	15	57
4	16	8.755747	11.244253	8.756453	11.243547	10.000706	9.999294	44	56
5	15	8.756300	11.243700	8.757008	11.242992	10.000708	9.999292	45	55
6	30	8.756852	11.243148	8.757562	11.242438	10.000710	9.999290	30	54
7	45	8.757404	11.242596	8.758115	11.241885	10.000712	9.999288	15	53
8	17	8.757955	11.242045	8.758668	11.241332	10.000714	9.999286	43	52
9	15	8.758505	11.241495	8.759220	11.240780	10.000715	9.999285	45	51
10	30	8.759054	11.240946	8.759771	11.240229	10.000717	9.999283	30	50
11	45	8.759603	11.240397	8.760322	11.239678	10.000719	9.999281	15	49
12	18	8.760151	11.239849	8.760872	11.239128	10.000721	9.999279	42	48
13	15	8.760699	11.239301	8.761421	11.238579	10.000723	9.999277	45	47
14	30	8.761245	11.238755	8.761970	11.238030	10.000724	9.999276	30	46
15	45	8.761791	11.238209	8.762517	11.237483	10.000726	9.999274	15	45
16	19	8.762337	11.237663	8.763065	11.236935	10.000728	9.999272	41	44
17	15	8.762881	11.237119	8.763611	11.236389	10.000730	9.999270	45	43
18	30	8.763425	11.236575	8.764157	11.235843	10.000732	9.999268	30	42
19	45	8.763968	11.236032	8.764702	11.235298	10.000734	9.999266	15	41
20	20	8.764511	11.235489	8.765246	11.234754	10.000735	9.999265	40	40
21	15	8.765053	11.234947	8.765790	11.234210	10.000737	9.999263	45	39
22	30	8.765594	11.234406	8.766333	11.233667	10.000739	9.999261	30	38
23	45	8.766135	11.233865	8.766876	11.233124	10.000741	9.999259	15	37
24	21	8.766675	11.233325	8.767417	11.232583	10.000743	9.999257	39	36
25	15	8.767214	11.232786	8.767958	11.232042	10.000745	9.999255	45	35
26	30	8.767752	11.232248	8.768499	11.231501	10.000747	9.999253	30	34
27	45	8.768290	11.231710	8.769039	11.230961	10.000748	9.999252	15	33
28	22	8.768827	11.231173	8.769578	11.230422	10.000750	9.999250	38	32
29	15	8.769364	11.230636	8.770116	11.229884	10.000752	9.999248	45	31
30	30	8.769900	11.230100	8.770654	11.229346	10.000754	9.999246	30	30
31	45	8.770435	11.229565	8.771191	11.228809	10.000756	9.999244	15	29
32	23	8.770970	11.229030	8.771727	11.228273	10.000758	9.999242	37	28
33	15	8.771504	11.228496	8.772263	11.227737	10.000760	9.999240	45	27
34	30	8.772037	11.227963	8.772798	11.227202	10.000761	9.999239	30	26
35	45	8.772569	11.227431	8.773333	11.226667	10.000763	9.999237	15	25
36	24	8.773101	11.226899	8.773866	11.226134	10.000765	9.999235	36	24
37	15	8.773633	11.226367	8.774400	11.225600	10.000767	9.999233	45	23
38	30	8.774163	11.225837	8.774932	11.225068	10.000769	9.999231	30	22
39	45	8.774693	11.225307	8.775464	11.224536	10.000771	9.999229	15	21
40	25	8.775223	11.224777	8.775995	11.224005	10.000773	9.999227	35	20
41	15	8.775751	11.224249	8.776526	11.223474	10.000775	9.999225	45	19
42	30	8.776279	11.223721	8.777056	11.222944	10.000776	9.999224	30	18
43	45	8.776807	11.223193	8.777585	11.222415	10.000778	9.999222	15	17
44	26	8.777333	11.222667	8.778114	11.221886	10.000780	9.999220	34	16
45	15	8.777859	11.222141	8.778642	11.221358	10.000782	9.999218	45	15
46	30	8.778385	11.221615	8.779169	11.220831	10.000784	9.999216	30	14
47	45	8.778910	11.221090	8.779696	11.220304	10.000786	9.999214	15	13
48	27	8.779434	11.220566	8.780222	11.219778	10.000788	9.999212	33	12
49	15	8.779958	11.220042	8.780747	11.219253	10.000790	9.999210	45	11
50	30	8.780480	11.219520	8.781272	11.218728	10.000792	9.999208	30	10
51	45	8.781003	11.218997	8.781796	11.218204	10.000794	9.999206	15	9
52	28	8.781524	11.218476	8.782320	11.217680	10.000795	9.999205	32	8
53	15	8.782045	11.217955	8.782843	11.217157	10.000797	9.999203	45	7
54	30	8.782566	11.217434	8.783365	11.216635	10.000799	9.999201	30	6
55	45	8.783086	11.216914	8.783887	11.216113	10.000801	9.999199	15	5
56	29	8.783605	11.216395	8.784408	11.215592	10.000803	9.999197	31	4
57	15	8.784123	11.215877	8.784928	11.215072	10.000805	9.999195	45	3
58	30	8.784641	11.215359	8.785448	11.214552	10.000807	9.999193	30	2
59	45	8.785159	11.214841	8.785967	11.214033	10.000809	9.999191	15	1
60	30	8.785675	11.214325	8.786486	11.213514	10.000811	9.999189	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 46 ^m .		LOG. SINES, &c.						86 deg.	

0 ^h 14 ^m .		LOG. SINES, &c. (t.)						3 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	30	8.785675	11.214325	8.786486	11.213514	10.000811	9.999189	30	60	
1	15	8.786191	11.213809	8.787004	11.212996	10.000813	9.999187	45	59	
2	30	8.786707	11.213293	8.787521	11.212479	10.000815	9.999185	30	58	
3	45	8.787222	11.212778	8.788038	11.211962	10.000817	9.999183	15	57	
4	31	8.787736	11.212264	8.788554	11.211446	10.000819	9.999181	29	56	
5	15	8.788251	11.211751	8.789070	11.210930	10.000821	9.999179	45	55	
6	30	8.788762	11.211238	8.789585	11.210415	10.000822	9.999178	30	54	
7	45	8.789275	11.210725	8.790099	11.209901	10.000824	9.999176	15	53	
8	32	8.789787	11.210213	8.790613	11.209387	10.000826	9.999174	28	52	
9	15	8.790298	11.209702	8.791126	11.208874	10.000828	9.999172	45	51	
10	30	8.790808	11.209192	8.791639	11.208361	10.000830	9.999170	30	50	
11	45	8.791318	11.208682	8.792151	11.207849	10.000832	9.999168	15	49	
12	33	8.791828	11.208172	8.792662	11.207338	10.000834	9.999166	27	48	
13	15	8.792337	11.207663	8.793173	11.206827	10.000836	9.999164	45	47	
14	30	8.792845	11.207155	8.793683	11.206317	10.000838	9.999162	30	46	
15	45	8.793352	11.206648	8.794192	11.205808	10.000840	9.999160	15	45	
16	34	8.793859	11.206141	8.794701	11.205299	10.000842	9.999158	26	44	
17	15	8.794366	11.205634	8.795210	11.204790	10.000844	9.999156	45	43	
18	30	8.794872	11.205128	8.795717	11.204283	10.000846	9.999154	30	42	
19	45	8.795377	11.204623	8.796225	11.203775	10.000848	9.999152	15	41	
20	35	8.795881	11.204119	8.796731	11.203269	10.000850	9.999150	25	40	
21	15	8.796385	11.203615	8.797237	11.202763	10.000852	9.999148	45	39	
22	30	8.796889	11.203111	8.797743	11.202257	10.000854	9.999146	30	38	
23	45	8.797392	11.202608	8.798248	11.201752	10.000856	9.999144	15	37	
24	36	8.797894	11.202106	8.798752	11.201248	10.000858	9.999142	24	36	
25	15	8.798396	11.201604	8.799256	11.200744	10.000860	9.999140	45	35	
26	30	8.798897	11.201103	8.799759	11.200241	10.000862	9.999138	30	34	
27	45	8.799397	11.200603	8.800261	11.199739	10.000864	9.999136	15	33	
28	37	8.799897	11.200103	8.800763	11.199237	10.000866	9.999134	23	32	
29	15	8.800397	11.199603	8.801265	11.198735	10.000868	9.999132	45	31	
30	30	8.800896	11.199104	8.801765	11.198235	10.000870	9.999130	30	30	
31	45	8.801394	11.198606	8.802266	11.197734	10.000872	9.999128	15	29	
32	38	8.801891	11.198109	8.802765	11.197235	10.000874	9.999126	22	28	
33	15	8.802389	11.197611	8.803264	11.196736	10.000876	9.999124	45	27	
34	30	8.802885	11.197115	8.803763	11.196237	10.000878	9.999122	30	26	
35	45	8.803381	11.196619	8.804261	11.195739	10.000880	9.999120	15	25	
36	39	8.803876	11.196124	8.804758	11.195242	10.000882	9.999118	21	24	
37	15	8.804371	11.195629	8.805255	11.194745	10.000884	9.999116	45	23	
38	30	8.804865	11.195135	8.805751	11.194249	10.000886	9.999114	30	22	
39	45	8.805359	11.194641	8.806247	11.193753	10.000888	9.999112	15	21	
40	40	8.805852	11.194148	8.806742	11.193258	10.000890	9.999110	20	20	
41	15	8.806345	11.193655	8.807237	11.192763	10.000892	9.999108	45	19	
42	30	8.806837	11.193163	8.807731	11.192269	10.000894	9.999106	30	18	
43	45	8.807328	11.192672	8.808224	11.191776	10.000896	9.999104	15	17	
44	41	8.807819	11.192181	8.808717	11.191283	10.000898	9.999102	19	16	
45	15	8.808309	11.191691	8.809210	11.190790	10.000900	9.999100	45	15	
46	30	8.808799	11.191201	8.809701	11.190299	10.000902	9.999098	30	14	
47	45	8.809288	11.190712	8.810193	11.189807	10.000904	9.999096	15	13	
48	42	8.809777	11.190223	8.810683	11.189317	10.000906	9.999094	18	12	
49	15	8.810265	11.189735	8.811173	11.188827	10.000908	9.999092	45	11	
50	30	8.810753	11.189247	8.811663	11.188337	10.000910	9.999090	30	10	
51	45	8.811240	11.188760	8.812152	11.187848	10.000912	9.999088	15	9	
52	43	8.811726	11.188274	8.812641	11.187359	10.000914	9.999086	17	8	
53	15	8.812212	11.187788	8.813129	11.186871	10.000916	9.999084	45	7	
54	30	8.812698	11.187302	8.813616	11.186384	10.000919	9.999081	30	6	
55	45	8.813182	11.186818	8.814103	11.185897	10.000921	9.999079	15	5	
56	44	8.813667	11.186333	8.814589	11.185411	10.000923	9.999077	16	4	
57	15	8.814150	11.185850	8.815075	11.184925	10.000925	9.999075	45	3	
58	30	8.814634	11.185366	8.815560	11.184440	10.000927	9.999073	30	2	
59	45	8.815116	11.184884	8.816045	11.183955	10.000929	9.999071	15	1	
60	45	8.815598	11.184402	8.816529	11.183471	10.000931	9.999069	15	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
5 ^h 45 ^m .		LOG. SINES, &c.						86 deg.		

0h 15m.		LOG. SINES, &c. (t)						3 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	45	8.815598	11.184402	8.816529	11.183471	10.000931	9.999069	15	60	
1	15	8.816080	11.183920	8.817013	11.182987	10.000933	9.999067	45	59	
2	30	8.816561	11.183439	8.817496	11.182504	10.000935	9.999065	30	58	
3	45	8.817042	11.182958	8.817979	11.182021	10.000937	9.999063	15	57	
4	46	8.817522	11.182478	8.818461	11.181539	10.000939	9.999061	14	56	
5	15	8.818001	11.181999	8.818942	11.181058	10.000941	9.999059	45	55	
6	30	8.818480	11.181520	8.819423	11.180577	10.000943	9.999057	30	54	
7	45	8.818958	11.181042	8.819904	11.180096	10.000945	9.999055	15	53	
8	47	8.819436	11.180564	8.820384	11.179616	10.000948	9.999052	13	52	
9	15	8.819914	11.180086	8.820863	11.179137	10.000950	9.999050	45	51	
10	30	8.820390	11.179610	8.821342	11.178658	10.000952	9.999048	30	50	
11	45	8.820867	11.179133	8.821820	11.178180	10.000954	9.999046	15	49	
12	48	8.821342	11.178658	8.822298	11.177702	10.000956	9.999044	12	48	
13	15	8.821818	11.178182	8.822776	11.177224	10.000958	9.999042	45	47	
14	30	8.822292	11.177708	8.823253	11.176747	10.000960	9.999040	30	46	
15	45	8.822767	11.177233	8.823729	11.176271	10.000962	9.999038	15	45	
16	49	8.823240	11.176760	8.824205	11.175795	10.000964	9.999036	11	44	
17	15	8.823713	11.176287	8.824680	11.175320	10.000966	9.999034	45	43	
18	30	8.824186	11.175814	8.825155	11.174845	10.000969	9.999031	30	42	
19	45	8.824658	11.175342	8.825629	11.174371	10.000971	9.999029	15	41	
20	50	8.825130	11.174870	8.826103	11.173897	10.000973	9.999027	10	40	
21	15	8.825601	11.174399	8.826576	11.173424	10.000975	9.999025	45	39	
22	30	8.826072	11.173928	8.827048	11.172952	10.000977	9.999023	30	38	
23	45	8.826542	11.173458	8.827521	11.172479	10.000979	9.999021	15	37	
24	51	8.827011	11.172989	8.827992	11.172008	10.000981	9.999019	9	36	
25	15	8.827480	11.172520	8.828464	11.171536	10.000983	9.999017	45	35	
26	30	8.827949	11.172051	8.828934	11.171066	10.000986	9.999014	30	34	
27	45	8.828417	11.171583	8.829404	11.170596	10.000988	9.999012	15	33	
28	52	8.828884	11.171116	8.829874	11.170126	10.000990	9.999010	8	32	
29	15	8.829351	11.170649	8.830343	11.169657	10.000992	9.999008	45	31	
30	30	8.829818	11.170182	8.830812	11.169188	10.000994	9.999006	30	30	
31	45	8.830284	11.169716	8.831280	11.168720	10.000996	9.999004	15	29	
32	53	8.830749	11.169251	8.831748	11.168252	10.000998	9.999002	7	28	
33	15	8.831214	11.168786	8.832215	11.167785	10.001000	9.999000	45	27	
34	30	8.831679	11.168321	8.832682	11.167318	10.001003	9.998997	30	26	
35	45	8.832143	11.167857	8.833148	11.166852	10.001005	9.998995	15	25	
36	54	8.832607	11.167393	8.833613	11.166387	10.001007	9.998993	6	24	
37	15	8.833070	11.166930	8.834079	11.165921	10.001009	9.998991	45	23	
38	30	8.833532	11.166468	8.834543	11.165457	10.001011	9.998989	30	22	
39	45	8.833994	11.166006	8.835007	11.164993	10.001013	9.998987	15	21	
40	55	8.834456	11.165544	8.835471	11.164529	10.001016	9.998984	5	20	
41	15	8.834917	11.165083	8.835934	11.164066	10.001018	9.998982	45	19	
42	30	8.835377	11.164623	8.836397	11.163603	10.001020	9.998980	30	18	
43	45	8.835837	11.164163	8.836859	11.163141	10.001022	9.998978	15	17	
44	56	8.836297	11.163703	8.837321	11.162679	10.001024	9.998976	4	16	
45	15	8.836756	11.163244	8.837782	11.162218	10.001026	9.998974	45	15	
46	30	8.837215	11.162785	8.838243	11.161757	10.001029	9.998971	30	14	
47	45	8.837673	11.162327	8.838703	11.161297	10.001031	9.998969	15	13	
48	57	8.838130	11.161870	8.839163	11.160837	10.001033	9.998967	3	12	
49	15	8.838587	11.161413	8.839623	11.160377	10.001035	9.998965	45	11	
50	30	8.839044	11.160956	8.840081	11.159919	10.001037	9.998963	30	10	
51	45	8.839500	11.160500	8.840540	11.159460	10.001039	9.998961	15	9	
52	58	8.839956	11.160044	8.840998	11.159002	10.001042	9.998958	2	8	
53	15	8.840411	11.159589	8.841455	11.158545	10.001044	9.998956	45	7	
54	30	8.840866	11.159134	8.841912	11.158088	10.001046	9.998954	30	6	
55	45	8.841320	11.158680	8.842368	11.157632	10.001048	9.998952	15	5	
56	59	8.841774	11.158226	8.842824	11.157176	10.001050	9.998950	1	4	
57	15	8.842227	11.157773	8.843280	11.156720	10.001053	9.998947	45	3	
58	30	8.842680	11.157320	8.843735	11.156265	10.001055	9.998945	30	2	
59	45	8.843133	11.156867	8.844190	11.155810	10.001057	9.998943	15	1	
60	60	8.843584	11.156416	8.844644	11.155356	10.001059	9.998941	0	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
5h 44m.		LOG SINES, &c.						86 deg.		

0 ^h 16 ^m .		LOG. SINES, &c. (t.)						4 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	8.843584	11.156416	8.844644	11.155356	10.001059	9.998941	60	60
1	15	8.844036	11.155964	8.845097	11.154903	10.001061	9.998939	45	59
2	30	8.844487	11.155513	8.845550	11.154450	10.001064	9.998936	30	58
3	45	8.844937	11.155063	8.846003	11.153997	10.001066	9.998934	15	57
4	1	8.845387	11.154613	8.846455	11.153545	10.001068	9.998932	59	56
5	15	8.845837	11.154163	8.846907	11.153093	10.001070	9.998930	45	55
6	30	8.846286	11.153714	8.847358	11.152642	10.001073	9.998927	30	54
7	45	8.846735	11.153265	8.847809	11.152191	10.001075	9.998925	15	53
8	2	8.847183	11.152817	8.848260	11.151740	10.001077	9.998923	58	52
9	15	8.847630	11.152370	8.848710	11.151290	10.001079	9.998921	45	51
10	30	8.848078	11.151922	8.849159	11.150841	10.001081	9.998919	30	50
11	45	8.848524	11.151476	8.849608	11.150392	10.001084	9.998916	15	49
12	3	8.848971	11.151029	8.850057	11.149943	10.001086	9.998914	57	48
13	15	8.849416	11.150584	8.850505	11.149495	10.001088	9.998912	45	47
14	30	8.849862	11.150138	8.850952	11.149048	10.001090	9.998910	30	46
15	45	8.850307	11.149693	8.851399	11.148601	10.001093	9.998907	15	45
16	4	8.850751	11.149249	8.851846	11.148154	10.001095	9.998905	56	44
17	15	8.851195	11.148805	8.852292	11.147708	10.001097	9.998903	45	43
18	30	8.851639	11.148361	8.852738	11.147262	10.001099	9.998901	30	42
19	45	8.852082	11.147918	8.853183	11.146817	10.001102	9.998898	15	41
20	5	8.852524	11.147476	8.853628	11.146372	10.001104	9.998896	55	40
21	15	8.852967	11.147033	8.854073	11.145927	10.001106	9.998894	45	39
22	30	8.853408	11.146592	8.854517	11.145483	10.001108	9.998892	30	38
23	45	8.853850	11.146150	8.854960	11.145040	10.001111	9.998889	15	37
24	6	8.854290	11.145710	8.855403	11.144597	10.001113	9.998887	54	36
25	15	8.854731	11.145269	8.855846	11.144154	10.001115	9.998885	45	35
26	30	8.855171	11.144829	8.856288	11.143712	10.001117	9.998883	30	34
27	45	8.855610	11.144390	8.856730	11.143270	10.001120	9.998880	15	33
28	7	8.856049	11.143951	8.857171	11.142829	10.001122	9.998878	53	32
29	15	8.856488	11.143512	8.857612	11.142388	10.001124	9.998876	45	31
30	30	8.856926	11.143074	8.858053	11.141947	10.001127	9.998873	30	30
31	45	8.857364	11.142636	8.858493	11.141507	10.001129	9.998871	15	29
32	8	8.857801	11.142199	8.858932	11.141068	10.001131	9.998869	52	28
33	15	8.858238	11.141762	8.859371	11.140629	10.001133	9.998867	45	27
34	30	8.858674	11.141326	8.859810	11.140190	10.001136	9.998864	30	26
35	45	8.859110	11.140890	8.860248	11.139752	10.001138	9.998862	15	25
36	9	8.859546	11.140454	8.860686	11.139314	10.001140	9.998860	51	24
37	15	8.859981	11.140019	8.861123	11.138877	10.001143	9.998857	45	23
38	30	8.860415	11.139585	8.861560	11.138440	10.001145	9.998855	30	22
39	45	8.860849	11.139151	8.861997	11.138003	10.001147	9.998853	15	21
40	10	8.861283	11.138717	8.862433	11.137567	10.001149	9.998851	50	20
41	15	8.861717	11.138283	8.862868	11.137132	10.001152	9.998848	45	19
42	30	8.862149	11.137851	8.863303	11.136697	10.001154	9.998846	30	18
43	45	8.862582	11.137418	8.863738	11.136262	10.001156	9.998844	15	17
44	11	8.863014	11.136986	8.864172	11.135828	10.001159	9.998841	49	16
45	15	8.863445	11.136555	8.864606	11.135394	10.001161	9.998839	45	15
46	30	8.863877	11.136123	8.865040	11.134960	10.001163	9.998837	30	14
47	45	8.864307	11.135693	8.865473	11.134527	10.001166	9.998834	15	13
48	12	8.864738	11.135262	8.865905	11.134095	10.001168	9.998832	48	12
49	15	8.865167	11.134833	8.866338	11.133662	10.001170	9.998830	45	11
50	30	8.865597	11.134403	8.866769	11.133231	10.001173	9.998827	30	10
51	45	8.866026	11.133974	8.867201	11.132799	10.001175	9.998825	15	9
52	13	8.866454	11.133546	8.867632	11.132368	10.001177	9.998823	47	8
53	15	8.866883	11.133117	8.868062	11.131938	10.001180	9.998820	45	7
54	30	8.867310	11.132690	8.868492	11.131508	10.001182	9.998818	30	6
55	45	8.867738	11.132262	8.868922	11.131078	10.001184	9.998816	15	5
56	14	8.868165	11.131835	8.869351	11.130649	10.001187	9.998813	46	4
57	15	8.868591	11.131409	8.869780	11.130220	10.001189	9.998811	45	3
58	30	8.869017	11.130983	8.870208	11.129792	10.001191	9.998809	30	2
59	45	8.869443	11.130557	8.870636	11.129364	10.001194	9.998806	15	1
60	15	8.869868	11.130132	8.871064	11.128936	10.001196	9.998804	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 43 ^m .		LOG. SINES, &c.						85 deg.	

0 ^h 17 ^m .		LOG. SINES, &c. (t.)						4 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	8.869868	11.130132	8.871064	11.128936	10.001196	9.998804	45	60
1	15	8.870293	11.129707	8.871491	11.128509	10.001198	9.998802	45	59
2	30	8.870717	11.129283	8.871918	11.128082	10.001201	9.998799	30	58
3	45	8.871141	11.128859	8.872344	11.127656	10.001203	9.998797	15	57
4	16	8.871565	11.128435	8.872770	11.127230	10.001205	9.998795	44	56
5	15	8.871988	11.128012	8.873195	11.126805	10.001208	9.998792	45	55
6	30	8.872410	11.127590	8.873620	11.126380	10.001210	9.998790	30	54
7	45	8.872833	11.127167	8.874045	11.125955	10.001212	9.998788	15	53
8	17	8.873255	11.126745	8.874469	11.125531	10.001215	9.998785	43	52
9	15	8.873676	11.126324	8.874893	11.125107	10.001217	9.998783	45	51
10	30	8.874097	11.125903	8.875317	11.124683	10.001220	9.998780	30	50
11	45	8.874518	11.125482	8.875740	11.124260	10.001222	9.998778	15	49
12	18	8.874938	11.125062	8.876162	11.123838	10.001224	9.998776	42	48
13	15	8.875358	11.124642	8.876584	11.123416	10.001227	9.998773	45	47
14	30	8.875777	11.124223	8.877006	11.122994	10.001229	9.998771	30	46
15	45	8.876196	11.123804	8.877428	11.122572	10.001231	9.998769	15	45
16	19	8.876615	11.123385	8.877849	11.122151	10.001234	9.998766	41	44
17	15	8.877033	11.122967	8.878269	11.121731	10.001236	9.998764	45	43
18	30	8.877451	11.122549	8.878689	11.121311	10.001239	9.998761	30	42
19	45	8.877868	11.122132	8.879109	11.120891	10.001241	9.998759	15	41
20	20	8.878285	11.121715	8.879529	11.120471	10.001243	9.998757	40	40
21	15	8.878702	11.121298	8.879948	11.120052	10.001246	9.998754	45	39
22	30	8.879118	11.120882	8.880366	11.119634	10.001248	9.998752	30	38
23	45	8.879534	11.120466	8.880784	11.119216	10.001251	9.998749	15	37
24	21	8.879949	11.120051	8.881202	11.118798	10.001253	9.998747	39	36
25	15	8.880364	11.119636	8.881620	11.118380	10.001255	9.998745	45	35
26	30	8.880779	11.119221	8.882037	11.117963	10.001258	9.998742	30	34
27	45	8.881193	11.118807	8.882453	11.117547	10.001260	9.998740	15	33
28	22	8.881607	11.118393	8.882869	11.117131	10.001263	9.998737	38	32
29	15	8.882020	11.117980	8.883285	11.116715	10.001265	9.998735	45	31
30	30	8.882433	11.117567	8.883701	11.116299	10.001267	9.998733	30	30
31	45	8.882846	11.117154	8.884116	11.115884	10.001270	9.998730	15	29
32	23	8.883258	11.116742	8.884530	11.115470	10.001272	9.998728	37	28
33	15	8.883670	11.116330	8.884945	11.115055	10.001275	9.998725	45	27
34	30	8.884081	11.115919	8.885358	11.114642	10.001277	9.998723	30	26
35	45	8.884492	11.115508	8.885772	11.114228	10.001279	9.998721	15	25
36	24	8.884903	11.115097	8.886185	11.113815	10.001282	9.998718	36	24
37	15	8.885313	11.114687	8.886598	11.113402	10.001284	9.998716	45	23
38	30	8.885723	11.114277	8.887010	11.112990	10.001287	9.998713	30	22
39	45	8.886133	11.113867	8.887422	11.112578	10.001289	9.998711	15	21
40	25	8.886542	11.113458	8.887833	11.112167	10.001292	9.998708	35	20
41	15	8.886950	11.113050	8.888244	11.111756	10.001294	9.998706	45	19
42	30	8.887359	11.112641	8.888655	11.111345	10.001297	9.998703	30	18
43	45	8.887767	11.112233	8.889066	11.110934	10.001299	9.998701	15	17
44	26	8.888174	11.111826	8.889476	11.110524	10.001301	9.998699	34	16
45	15	8.888581	11.111419	8.889885	11.110115	10.001304	9.998696	45	15
46	30	8.888988	11.111012	8.890294	11.109706	10.001306	9.998694	30	14
47	45	8.889395	11.110605	8.890703	11.109297	10.001309	9.998691	15	13
48	27	8.889801	11.110199	8.891112	11.108888	10.001311	9.998689	33	12
49	15	8.890206	11.109794	8.891520	11.108480	10.001314	9.998686	45	11
50	30	8.890612	11.109388	8.891928	11.108072	10.001316	9.998684	30	10
51	45	8.891016	11.108984	8.892335	11.107665	10.001319	9.998681	15	9
52	28	8.891421	11.108579	8.892742	11.107258	10.001321	9.998679	32	8
53	15	8.891825	11.108175	8.893148	11.106852	10.001324	9.998676	45	7
54	30	8.892229	11.107771	8.893555	11.106445	10.001326	9.998674	30	6
55	45	8.892632	11.107368	8.893961	11.106039	10.001329	9.998671	15	5
56	29	8.893035	11.106965	8.894366	11.105634	10.001331	9.998669	31	4
57	15	8.893438	11.106562	8.894771	11.105229	10.001333	9.998667	45	3
58	30	8.893840	11.106160	8.895176	11.104824	10.001336	9.998664	30	2
59	45	8.894242	11.105758	8.895580	11.104420	10.001338	9.998662	15	1
60	30	8.894643	11.105357	8.895984	11.104016	10.001341	9.998659	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 42 ^m .		LOG. SINES, &c.						85 deg.	

0 ^h 18 ^m .			LOG. SINES, &c. (t.)						4 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0	30		8.894643	11.105357	8.895984	11.104016	10.001341	9.998659	30		60
1	15		8.895044	11.104956	8.896388	11.103612	10.001343	9.998657	45		59
2	30		8.895445	11.104555	8.896791	11.103209	10.001346	9.998654	30		58
3	45		8.895845	11.104155	8.897194	11.102806	10.001348	9.998652	15		57
4	31		8.896245	11.103755	8.897596	11.102404	10.001351	9.998649	29		56
5	15		8.896645	11.103355	8.897998	11.102002	10.001353	9.998647	45		55
6	30		8.897044	11.102956	8.898400	11.101600	10.001356	9.998644	30		54
7	45		8.897443	11.102557	8.898802	11.101198	10.001358	9.998642	15		53
8	32		8.897842	11.102158	8.899203	11.100797	10.001361	9.998639	28		52
9	15		8.898240	11.101760	8.899603	11.100397	10.001363	9.998637	45		51
10	30		8.898638	11.101362	8.900004	11.099996	10.001366	9.998634	30		50
11	45		8.899035	11.100965	8.900403	11.099597	10.001368	9.998632	15		49
12	33		8.899432	11.100568	8.900803	11.099197	10.001371	9.998629	27		48
13	15		8.899829	11.100171	8.901202	11.098798	10.001373	9.998627	45		47
14	30		8.900225	11.099775	8.901601	11.098399	10.001376	9.998624	30		46
15	45		8.900621	11.099379	8.902000	11.098000	10.001378	9.998622	15		45
16	34		8.901017	11.098983	8.902398	11.097602	10.001381	9.998619	26		44
17	15		8.901412	11.098588	8.902795	11.097205	10.001383	9.998617	45		43
18	30		8.901807	11.098193	8.903193	11.096807	10.001386	9.998614	30		42
19	45		8.902201	11.097799	8.903590	11.096410	10.001389	9.998611	15		41
20	35		8.902595	11.097405	8.903987	11.096013	10.001391	9.998609	25		40
21	15		8.902989	11.097011	8.904383	11.095617	10.001394	9.998606	45		39
22	30		8.903383	11.096617	8.904779	11.095221	10.001396	9.998604	30		38
23	45		8.903776	11.096224	8.905174	11.094826	10.001399	9.998601	15		37
24	36		8.904168	11.095832	8.905570	11.094430	10.001401	9.998599	24		36
25	15		8.904561	11.095439	8.905965	11.094035	10.001404	9.998596	45		35
26	30		8.904953	11.095047	8.906359	11.093641	10.001406	9.998594	30		34
27	45		8.905345	11.094655	8.906753	11.093247	10.001409	9.998591	15		33
28	37		8.905736	11.094264	8.907147	11.092853	10.001411	9.998589	23		32
29	15		8.906127	11.093873	8.907541	11.092459	10.001414	9.998586	45		31
30	30		8.906517	11.093483	8.907934	11.092066	10.001417	9.998583	30		30
31	45		8.906908	11.093092	8.908327	11.091673	10.001419	9.998581	15		29
32	38		8.907297	11.092703	8.908719	11.091281	10.001422	9.998578	22		28
33	15		8.907687	11.092313	8.909111	11.090889	10.001424	9.998576	45		27
34	30		8.908076	11.091924	8.909503	11.090497	10.001427	9.998573	30		26
35	45		8.908465	11.091535	8.909894	11.090106	10.001429	9.998571	15		25
36	39		8.908853	11.091147	8.910285	11.089715	10.001432	9.998568	21		24
37	15		8.909242	11.090758	8.910676	11.089324	10.001434	9.998566	45		23
38	30		8.909629	11.090371	8.911066	11.088934	10.001437	9.998563	30		22
39	45		8.910017	11.089983	8.911456	11.088544	10.001440	9.998560	15		21
40	40		8.910404	11.089596	8.911846	11.088154	10.001442	9.998558	20		20
41	15		8.910791	11.089209	8.912235	11.087765	10.001445	9.998555	45		19
42	30		8.911177	11.088823	8.912624	11.087376	10.001447	9.998553	30		18
43	45		8.911563	11.088437	8.913013	11.086987	10.001450	9.998550	15		17
44	41		8.911949	11.088051	8.913401	11.086599	10.001453	9.998547	19		16
45	15		8.912334	11.087666	8.913789	11.086211	10.001455	9.998545	45		15
46	30		8.912719	11.087281	8.914177	11.085823	10.001458	9.998542	30		14
47	45		8.913104	11.086896	8.914564	11.085436	10.001460	9.998540	15		13
48	42		8.913488	11.086512	8.914951	11.085049	10.001463	9.998537	18		12
49	15		8.913872	11.086128	8.915337	11.084663	10.001465	9.998535	45		11
50	30		8.914256	11.085744	8.915724	11.084276	10.001468	9.998532	30		10
51	45		8.914639	11.085361	8.916110	11.083890	10.001471	9.998529	15		9
52	43		8.915022	11.084978	8.916495	11.083505	10.001473	9.998527	17		8
53	15		8.915404	11.084596	8.916880	11.083120	10.001476	9.998524	45		7
54	30		8.915787	11.084213	8.917265	11.082735	10.001478	9.998522	30		6
55	45		8.916169	11.083831	8.917650	11.082350	10.001481	9.998519	15		5
56	44		8.916550	11.083450	8.918034	11.081966	10.001484	9.998516	16		4
57	15		8.916932	11.083068	8.918418	11.081582	10.001486	9.998514	45		3
58	30		8.917312	11.082688	8.918801	11.081199	10.001489	9.998511	30		2
59	45		8.917693	11.082307	8.919185	11.080815	10.001492	9.998508	15		1
60	45		8.918073	11.081927	8.919567	11.080433	10.001494	9.998506	15		0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.
5 ^h 41 ^m .			LOG. SINES, &c.						85 deg.		

0 ^h 19 ^m .		LOG. SINES, &c. (t.)						4 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	45	8.918073	11.081927	8.919567	11.080433	10.001494	9.998506	15	60	
1	15	8.918453	11.081547	8.919950	11.080050	10.001497	9.998503	45	59	
2	30	8.918833	11.081167	8.920332	11.079668	10.001499	9.998501	30	58	
3	45	8.919212	11.080788	8.920714	11.079286	10.001502	9.998498	15	57	
4	46	8.919591	11.080409	8.921096	11.078904	10.001505	9.998495	14	56	
5	15	8.919970	11.080030	8.921477	11.078523	10.001507	9.998493	45	55	
6	30	8.920348	11.079652	8.921858	11.078142	10.001510	9.998490	30	54	
7	45	8.920726	11.079274	8.922238	11.077762	10.001513	9.998487	15	53	
8	47	8.921103	11.078897	8.922619	11.077381	10.001515	9.998485	13	52	
9	15	8.921481	11.078519	8.922998	11.077002	10.001518	9.998482	45	51	
10	30	8.921858	11.078142	8.923378	11.076622	10.001521	9.998479	30	50	
11	45	8.922234	11.077766	8.923757	11.076243	10.001523	9.998477	15	49	
12	48	8.922610	11.077390	8.924136	11.075864	10.001526	9.998474	12	48	
13	15	8.922986	11.077014	8.924515	11.075485	10.001529	9.998471	45	47	
14	30	8.923362	11.076638	8.924893	11.075107	10.001531	9.998469	30	46	
15	45	8.923737	11.076263	8.925271	11.074729	10.001534	9.998466	15	45	
16	49	8.924112	11.075888	8.925649	11.074351	10.001536	9.998464	11	44	
17	15	8.924487	11.075513	8.926026	11.073974	10.001539	9.998461	45	43	
18	30	8.924861	11.075139	8.926403	11.073597	10.001542	9.998458	30	42	
19	45	8.925235	11.074765	8.926780	11.073220	10.001544	9.998456	15	41	
20	50	8.925609	11.074391	8.927156	11.072844	10.001547	9.998453	10	40	
21	15	8.925982	11.074018	8.927532	11.072468	10.001550	9.998450	45	39	
22	30	8.926355	11.073645	8.927908	11.072092	10.001552	9.998448	30	38	
23	45	8.926728	11.073272	8.928283	11.071717	10.001555	9.998445	15	37	
24	51	8.927100	11.072900	8.928658	11.071342	10.001558	9.998442	9	36	
25	15	8.927472	11.072528	8.929033	11.070967	10.001561	9.998439	45	35	
26	30	8.927844	11.072156	8.929407	11.070593	10.001563	9.998437	30	34	
27	45	8.928215	11.071785	8.929781	11.070219	10.001566	9.998434	15	33	
28	52	8.928587	11.071413	8.930155	11.069845	10.001569	9.998431	8	32	
29	15	8.928957	11.071043	8.930529	11.069471	10.001571	9.998429	45	31	
30	30	8.929328	11.070672	8.930902	11.069098	10.001574	9.998426	30	30	
31	45	8.929698	11.070302	8.931275	11.068725	10.001577	9.998423	15	29	
32	53	8.930068	11.069932	8.931647	11.068353	10.001579	9.998421	7	28	
33	15	8.930437	11.069563	8.932019	11.067981	10.001582	9.998418	45	27	
34	30	8.930806	11.069194	8.932391	11.067609	10.001585	9.998415	30	26	
35	45	8.931175	11.068825	8.932763	11.067237	10.001587	9.998413	15	25	
36	54	8.931544	11.068456	8.933134	11.066866	10.001590	9.998410	6	24	
37	15	8.931912	11.068088	8.933505	11.066495	10.001593	9.998407	45	23	
38	30	8.932280	11.067720	8.933876	11.066124	10.001596	9.998404	30	22	
39	45	8.932648	11.067352	8.934246	11.065754	10.001598	9.998402	15	21	
40	55	8.933015	11.066985	8.934616	11.065384	10.001601	9.998399	5	20	
41	15	8.933382	11.066618	8.934986	11.065014	10.001604	9.998396	45	19	
42	30	8.933749	11.066251	8.935355	11.064645	10.001606	9.998394	30	18	
43	45	8.934115	11.065885	8.935724	11.064276	10.001609	9.998391	15	17	
44	56	8.934481	11.065519	8.936093	11.063907	10.001612	9.998388	4	16	
45	15	8.934847	11.065153	8.936461	11.063539	10.001615	9.998385	45	15	
46	30	8.935212	11.064788	8.936830	11.063170	10.001617	9.998383	30	14	
47	45	8.935577	11.064423	8.937197	11.062803	10.001620	9.998380	15	13	
48	57	8.935942	11.064058	8.937565	11.062435	10.001623	9.998377	3	12	
49	15	8.936307	11.063693	8.937932	11.062068	10.001626	9.998374	45	11	
50	30	8.936671	11.063329	8.938299	11.061701	10.001628	9.998372	30	10	
51	45	8.937035	11.062965	8.938666	11.061334	10.001631	9.998369	15	9	
52	58	8.937398	11.062602	8.939032	11.060968	10.001634	9.998366	2	8	
53	15	8.937762	11.062238	8.939398	11.060602	10.001637	9.998363	45	7	
54	30	8.938125	11.061875	8.939764	11.060236	10.001639	9.998361	30	6	
55	45	8.938487	11.061513	8.940129	11.059871	10.001642	9.998358	15	5	
56	59	8.938850	11.061150	8.940494	11.059506	10.001645	9.998355	1	4	
57	15	8.939212	11.060788	8.940859	11.059141	10.001648	9.998352	45	3	
58	30	8.939573	11.060427	8.941224	11.058776	10.001650	9.998350	30	2	
59	45	8.939935	11.060065	8.941588	11.058412	10.001653	9.998347	15	1	
60	60	8.940296	11.059704	8.941952	11.058048	10.001656	9.998344	0	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
5 ^h 40 ^m .		LOG. SINES, &c.						85 deg.		

0 ^h 20 ^m .			LOG. SINES, &c. (t.)					5 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	sec.
0	0		8.940296	11.059704	8.941952	11.058048	10.001656	9.998344	60	60
1	15		8.940657	11.059343	8.942315	11.057685	10.001659	9.998341	45	59
2	30		8.941017	11.058983	8.942679	11.057321	10.001661	9.998339	30	58
3	45		8.941378	11.058622	8.943042	11.056958	10.001664	9.998336	15	57
4	1		8.941738	11.058262	8.943404	11.056596	10.001667	9.998333	59	56
5	15		8.942097	11.057903	8.943767	11.056233	10.001670	9.998330	45	55
6	30		8.942456	11.057544	8.944129	11.055871	10.001672	9.998328	30	54
7	45		8.942816	11.057184	8.944491	11.055509	10.001675	9.998325	15	53
8	2		8.943174	11.056826	8.944852	11.055148	10.001678	9.998322	58	52
9	15		8.943533	11.056467	8.945213	11.054787	10.001681	9.998319	45	51
10	30		8.943891	11.056109	8.945574	11.054426	10.001684	9.998316	30	50
11	45		8.944249	11.055751	8.945935	11.054065	10.001686	9.998314	15	49
12	3		8.944606	11.055394	8.946295	11.053705	10.001689	9.998311	57	48
13	15		8.944963	11.055037	8.946655	11.053345	10.001692	9.998308	45	47
14	30		8.945320	11.054680	8.947015	11.052985	10.001695	9.998305	30	46
15	45		8.945677	11.054323	8.947375	11.052625	10.001698	9.998302	15	45
16	4		8.946033	11.053967	8.947734	11.052266	10.001700	9.998300	56	44
17	15		8.946390	11.053610	8.948093	11.051907	10.001703	9.998297	45	43
18	30		8.946745	11.053255	8.948451	11.051549	10.001706	9.998294	30	42
19	45		8.947101	11.052899	8.948810	11.051190	10.001709	9.998291	15	41
20	5		8.947456	11.052544	8.949168	11.050832	10.001712	9.998288	55	40
21	15		8.947811	11.052189	8.949525	11.050475	10.001714	9.998286	45	39
22	30		8.948166	11.051834	8.949883	11.050117	10.001717	9.998283	30	38
23	45		8.948520	11.051480	8.950240	11.049760	10.001720	9.998280	15	37
24	6		8.948874	11.051126	8.950597	11.049403	10.001723	9.998277	54	36
25	15		8.949228	11.050772	8.950953	11.049047	10.001726	9.998274	45	35
26	30		8.949581	11.050419	8.951309	11.048691	10.001728	9.998272	30	34
27	45		8.949934	11.050066	8.951665	11.048335	10.001731	9.998269	15	33
28	7		8.950287	11.049713	8.952021	11.047979	10.001734	9.998266	53	32
29	15		8.950640	11.049360	8.952376	11.047624	10.001737	9.998263	45	31
30	30		8.950992	11.049008	8.952732	11.047268	10.001740	9.998260	30	30
31	45		8.951344	11.048656	8.953086	11.046914	10.001743	9.998257	15	29
32	8		8.951696	11.048304	8.953441	11.046559	10.001745	9.998255	52	28
33	15		8.952047	11.047953	8.953795	11.046205	10.001748	9.998252	45	27
34	30		8.952398	11.047602	8.954149	11.045851	10.001751	9.998249	30	26
35	45		8.952749	11.047251	8.954503	11.045497	10.001754	9.998246	15	25
36	9		8.953100	11.046900	8.954856	11.045144	10.001757	9.998243	51	24
37	15		8.953450	11.046550	8.955209	11.044791	10.001760	9.998240	45	23
38	30		8.953800	11.046200	8.955562	11.044438	10.001762	9.998238	30	22
39	45		8.954150	11.045850	8.955915	11.044085	10.001765	9.998235	15	21
40	10		8.954499	11.045501	8.956267	11.043733	10.001768	9.998232	50	20
41	15		8.954848	11.045152	8.956619	11.043381	10.001771	9.998229	45	19
42	30		8.955197	11.044803	8.956971	11.043029	10.001774	9.998226	30	18
43	45		8.955546	11.044454	8.957322	11.042678	10.001777	9.998223	15	17
44	11		8.955894	11.044106	8.957673	11.042327	10.001780	9.998220	49	16
45	15		8.956242	11.043758	8.958024	11.041976	10.001783	9.998217	45	15
46	30		8.956590	11.043410	8.958375	11.041625	10.001785	9.998215	30	14
47	45		8.956937	11.043063	8.958725	11.041275	10.001788	9.998212	15	13
48	12		8.957284	11.042716	8.959075	11.040925	10.001791	9.998209	48	12
49	15		8.957631	11.042369	8.959425	11.040575	10.001794	9.998206	45	11
50	30		8.957978	11.042022	8.959775	11.040225	10.001797	9.998203	30	10
51	45		8.958324	11.041676	8.960124	11.039876	10.001800	9.998200	15	9
52	13		8.958670	11.041330	8.960473	11.039527	10.001803	9.998197	47	8
53	15		8.959016	11.040984	8.960821	11.039179	10.001806	9.998194	45	7
54	30		8.959361	11.040639	8.961170	11.038830	10.001808	9.998192	30	6
55	45		8.959707	11.040293	8.961518	11.038482	10.001811	9.998189	15	5
56	14		8.960052	11.039948	8.961866	11.038134	10.001814	9.998186	46	4
57	15		8.960396	11.039604	8.962213	11.037787	10.001817	9.998183	45	3
58	30		8.960741	11.039259	8.962561	11.037439	10.001820	9.998180	30	2
59	45		8.961085	11.038915	8.962908	11.037092	10.001823	9.998177	15	1
60	15		8.961429	11.038571	8.963254	11.036746	10.001826	9.998174	45	0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	sec.

5^h 39^m.

LOG. SINES, &c.

84 deg.

0 ^h 21 ^m .		LOG. SINES, &c. (t)						5 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	8.961429	11.038571	8.963254	11.036746	10.001826	9.998174	45	60
1	15	8.961772	11.038228	8.963601	11.036399	10.001829	9.998171	45	59
2	30	8.962116	11.037884	8.963947	11.036053	10.001832	9.998168	30	58
3	45	8.962459	11.037541	8.964293	11.035707	10.001834	9.998166	15	57
4	16	8.962801	11.037199	8.964639	11.035361	10.001837	9.998163	44	56
5	15	8.963144	11.036856	8.964984	11.035016	10.001840	9.998160	45	55
6	30	8.963486	11.036514	8.965329	11.034671	10.001843	9.998157	30	54
7	45	8.963828	11.036172	8.965674	11.034326	10.001846	9.998154	15	53
8	17	8.964170	11.035830	8.966019	11.033981	10.001849	9.998151	43	52
9	15	8.964511	11.035489	8.966363	11.033637	10.001852	9.998148	45	51
10	30	8.964852	11.035148	8.966707	11.033293	10.001855	9.998145	30	50
11	45	8.965193	11.034807	8.967051	11.032949	10.001858	9.998142	15	49
12	18	8.965534	11.034466	8.967394	11.032606	10.001861	9.998139	42	48
13	15	8.965874	11.034126	8.967738	11.032262	10.001864	9.998136	45	47
14	30	8.966214	11.033786	8.968081	11.031919	10.001867	9.998133	30	46
15	45	8.966554	11.033446	8.968423	11.031577	10.001870	9.998130	15	45
16	19	8.966893	11.033107	8.968766	11.031234	10.001873	9.998127	41	44
17	15	8.967233	11.032767	8.969108	11.030892	10.001875	9.998125	45	43
18	30	8.967572	11.032428	8.969450	11.030550	10.001878	9.998122	30	42
19	45	8.967910	11.032090	8.969792	11.030208	10.001881	9.998119	15	41
20	20	8.968249	11.031751	8.970133	11.029867	10.001884	9.998116	40	40
21	15	8.968587	11.031413	8.970474	11.029526	10.001887	9.998113	45	39
22	30	8.968925	11.031075	8.970815	11.029185	10.001890	9.998110	30	38
23	45	8.969262	11.030738	8.971156	11.028844	10.001893	9.998107	15	37
24	21	8.969600	11.030400	8.971496	11.028504	10.001896	9.998104	39	36
25	15	8.969937	11.030063	8.971836	11.028164	10.001899	9.998101	45	35
26	30	8.970274	11.029726	8.972176	11.027824	10.001902	9.998098	30	34
27	45	8.970610	11.029390	8.972515	11.027485	10.001905	9.998095	15	33
28	22	8.970947	11.029053	8.972855	11.027145	10.001908	9.998092	38	32
29	15	8.971283	11.028717	8.973194	11.026806	10.001911	9.998089	45	31
30	30	8.971619	11.028381	8.973532	11.026468	10.001914	9.998086	30	30
31	45	8.971954	11.028046	8.973871	11.026129	10.001917	9.998083	15	29
32	23	8.972289	11.027711	8.974209	11.025791	10.001920	9.998080	37	28
33	15	8.972624	11.027376	8.974547	11.025453	10.001923	9.998077	45	27
34	30	8.972959	11.027041	8.974885	11.025115	10.001926	9.998074	30	26
35	45	8.973294	11.026706	8.975222	11.024778	10.001929	9.998071	15	25
36	24	8.973628	11.026372	8.975560	11.024440	10.001932	9.998068	36	24
37	15	8.973962	11.026038	8.975897	11.024103	10.001935	9.998065	45	23
38	30	8.974296	11.025704	8.976233	11.023767	10.001938	9.998062	30	22
39	45	8.974629	11.025371	8.976570	11.023430	10.001941	9.998059	15	21
40	25	8.974962	11.025038	8.976906	11.023094	10.001944	9.998056	35	20
41	15	8.975295	11.024705	8.977242	11.022758	10.001947	9.998053	45	19
42	30	8.975628	11.024372	8.977578	11.022422	10.001950	9.998050	30	18
43	45	8.975960	11.024040	8.977913	11.022087	10.001953	9.998047	15	17
44	26	8.976293	11.023707	8.978248	11.021752	10.001956	9.998044	34	16
45	15	8.976624	11.023376	8.978583	11.021417	10.001959	9.998041	45	15
46	30	8.976956	11.023044	8.978918	11.021082	10.001962	9.998038	30	14
47	45	8.977288	11.022712	8.979252	11.020748	10.001965	9.998035	15	13
48	27	8.977619	11.022381	8.979586	11.020414	10.001968	9.998032	33	12
49	15	8.977950	11.022050	8.979920	11.020080	10.001971	9.998029	45	11
50	30	8.978280	11.021720	8.980254	11.019746	10.001974	9.998026	30	10
51	45	8.978611	11.021389	8.980587	11.019413	10.001977	9.998023	15	9
52	28	8.978941	11.021059	8.980921	11.019079	10.001980	9.998020	32	8
53	15	8.979271	11.020729	8.981253	11.018747	10.001983	9.998017	45	7
54	30	8.979600	11.020400	8.981586	11.018414	10.001986	9.998014	30	6
55	45	8.979930	11.020070	8.981919	11.018081	10.001989	9.998011	15	5
56	29	8.980259	11.019741	8.982251	11.017749	10.001992	9.998008	31	4
57	15	8.980588	11.019412	8.982583	11.017417	10.001995	9.998005	45	3
58	30	8.980916	11.019084	8.982914	11.017086	10.001998	9.998002	30	2
59	45	8.981245	11.018755	8.983246	11.016754	10.002001	9.997999	15	1
60	30	8.981573	11.018427	8.983577	11.016423	10.002004	9.997996	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 38 ^m .		LOG. SINES, &c.						84 deg.	

0 ^h 22 ^m .		LOG. SINES, &c. (t.)						5 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	8.981573	11.018427	8.983577	11.016423	10.002004	9.997996	30	60
1	15	8.981901	11.018099	8.983908	11.016092	10.002007	9.997993	45	59
2	30	8.982228	11.017772	8.984238	11.015762	10.002010	9.997990	30	58
3	45	8.982556	11.017444	8.984569	11.015431	10.002013	9.997987	15	57
4	31	8.982883	11.017117	8.984899	11.015101	10.002016	9.997984	29	56
5	15	8.983210	11.016790	8.985229	11.014771	10.002019	9.997981	45	55
6	30	8.983538	11.016464	8.985559	11.014441	10.002022	9.997978	30	54
7	45	8.983863	11.016137	8.985888	11.014112	10.002025	9.997975	15	53
8	32	8.984189	11.015811	8.986217	11.013783	10.002028	9.997972	28	52
9	15	8.984515	11.015485	8.986546	11.013454	10.002032	9.997968	45	51
10	30	8.984840	11.015160	8.986875	11.013125	10.002035	9.997965	30	50
11	45	8.985166	11.014834	8.987203	11.012797	10.002038	9.997962	15	49
12	33	8.985491	11.014509	8.987532	11.012468	10.002041	9.997959	27	48
13	15	8.985816	11.014184	8.987860	11.012140	10.002044	9.997956	45	47
14	30	8.986141	11.013860	8.988187	11.011813	10.002047	9.997953	30	46
15	45	8.986465	11.013535	8.988515	11.011485	10.002050	9.997950	15	45
16	34	8.986789	11.013211	8.988842	11.011158	10.002053	9.997947	26	44
17	15	8.987113	11.012887	8.989169	11.010831	10.002056	9.997944	45	43
18	30	8.987437	11.012563	8.989496	11.010504	10.002059	9.997941	30	42
19	45	8.987760	11.012240	8.989822	11.010178	10.002062	9.997938	15	41
20	35	8.988083	11.011917	8.990149	11.009851	10.002065	9.997935	25	40
21	15	8.988406	11.011594	8.990475	11.009525	10.002068	9.997932	45	39
22	30	8.988729	11.011271	8.990800	11.009200	10.002072	9.997928	30	38
23	45	8.989051	11.010949	8.991126	11.008874	10.002075	9.997925	15	37
24	36	8.989374	11.010626	8.991451	11.008549	10.002078	9.997922	24	36
25	15	8.989696	11.010304	8.991776	11.008224	10.002081	9.997919	45	35
26	30	8.990017	11.009983	8.992101	11.007899	10.002084	9.997916	30	34
27	45	8.990339	11.009661	8.992426	11.007574	10.002087	9.997913	15	33
28	37	8.990660	11.009340	8.992750	11.007250	10.002090	9.997910	23	32
29	15	8.990981	11.009019	8.993074	11.006926	10.002093	9.997907	45	31
30	30	8.991302	11.008698	8.993398	11.006602	10.002096	9.997904	30	30
31	45	8.991623	11.008377	8.993722	11.006278	10.002099	9.997901	15	29
32	38	8.991943	11.008057	8.994045	11.005955	10.002103	9.997897	22	28
33	15	8.992263	11.007737	8.994369	11.005631	10.002106	9.997894	45	27
34	30	8.992583	11.007417	8.994691	11.005309	10.002109	9.997891	30	26
35	45	8.992902	11.007098	8.995014	11.004986	10.002112	9.997888	15	25
36	39	8.993222	11.006778	8.995337	11.004663	10.002115	9.997885	21	24
37	15	8.993541	11.006459	8.995659	11.004341	10.002118	9.997882	45	23
38	30	8.993860	11.006140	8.995981	11.004019	10.002121	9.997879	30	22
39	45	8.994178	11.005822	8.996303	11.003697	10.002124	9.997876	15	21
40	40	8.994497	11.005503	8.996624	11.003376	10.002128	9.997872	20	20
41	15	8.994815	11.005185	8.996946	11.003054	10.002131	9.997869	45	19
42	30	8.995133	11.004867	8.997267	11.002733	10.002134	9.997866	30	18
43	45	8.995451	11.004549	8.997587	11.002413	10.002137	9.997863	15	17
44	41	8.995768	11.004232	8.997908	11.002092	10.002140	9.997860	19	16
45	15	8.996085	11.003915	8.998228	11.001772	10.002143	9.997857	45	15
46	30	8.996402	11.003598	8.998549	11.001451	10.002146	9.997854	30	14
47	45	8.996719	11.003281	8.998869	11.001131	10.002150	9.997850	15	13
48	42	8.997036	11.002964	8.999188	11.000812	10.002153	9.997847	18	12
49	15	8.997352	11.002648	8.999508	11.000492	10.002156	9.997844	45	11
50	30	8.997668	11.002332	8.999827	11.000173	10.002159	9.997841	30	10
51	45	8.997984	11.002016	9.000146	10.999854	10.002162	9.997838	15	9
52	43	8.998299	11.001701	9.000465	10.999535	10.002165	9.997835	17	8
53	15	8.998615	11.001385	9.000783	10.999217	10.002169	9.997831	45	7
54	30	8.998930	11.001070	9.001102	10.998898	10.002172	9.997828	30	6
55	45	8.999245	11.000755	9.001420	10.998580	10.002175	9.997825	15	5
56	44	8.999559	11.000441	9.001737	10.998263	10.002178	9.997822	16	4
57	15	8.999874	11.000126	9.002055	10.997945	10.002181	9.997819	45	3
58	30	9.000188	10.999812	9.002372	10.997628	10.002184	9.997816	30	2
59	45	9.000502	10.999498	9.002690	10.997310	10.002188	9.997812	15	1
60	45	9.000816	10.999184	9.003007	10.996993	10.002191	9.997809	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
5 ^h 37 ^m .		LOG. SINES, &c.						84 deg.	

0 ^h 23 ^m .			LOG. SINES, &c. (t)						5 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.		
0	45	9.000816	10.999184	9.003007	10.996993	10.002191	9.997809	15	60		
1	15	9.001129	10.998871	9.003323	10.996677	10.002194	9.997806	45	59		
2	30	9.001443	10.998557	9.003640	10.996360	10.002197	9.997803	30	58		
3	45	9.001756	10.998244	9.003956	10.996044	10.002200	9.997800	15	57		
4	46	9.002069	10.997931	9.004272	10.995728	10.002203	9.997797	14	56		
5	15	9.002381	10.997619	9.004588	10.995412	10.002207	9.997793	45	55		
6	30	9.002694	10.997306	9.004903	10.995097	10.002210	9.997790	30	54		
7	45	9.003006	10.996994	9.005219	10.994781	10.002213	9.997787	15	53		
8	47	9.003318	10.996682	9.005534	10.994466	10.002216	9.997784	13	52		
9	15	9.003630	10.996370	9.005849	10.994151	10.002219	9.997781	45	51		
10	30	9.003941	10.996059	9.006164	10.993836	10.002223	9.997777	30	50		
11	45	9.004252	10.995748	9.006478	10.993522	10.002226	9.997774	15	49		
12	48	9.004563	10.995437	9.006792	10.993208	10.002229	9.997771	12	48		
13	15	9.004874	10.995126	9.007106	10.992894	10.002232	9.997768	45	47		
14	30	9.005185	10.994815	9.007420	10.992580	10.002235	9.997765	30	46		
15	45	9.005495	10.994505	9.007734	10.992266	10.002239	9.997761	15	45		
16	49	9.005805	10.994195	9.008047	10.991953	10.002242	9.997758	11	44		
17	15	9.006115	10.993885	9.008360	10.991640	10.002245	9.997755	45	43		
18	30	9.006425	10.993575	9.008673	10.991327	10.002248	9.997752	30	42		
19	45	9.006734	10.993266	9.008986	10.991014	10.002252	9.997748	15	41		
20	50	9.007044	10.992956	9.009298	10.990702	10.002255	9.997745	10	40		
21	15	9.007353	10.992647	9.009611	10.990389	10.002258	9.997742	45	39		
22	30	9.007661	10.992339	9.009923	10.990077	10.002261	9.997739	30	38		
23	45	9.007970	10.992030	9.010234	10.989766	10.002264	9.997736	15	37		
24	51	9.008278	10.991722	9.010546	10.989454	10.002268	9.997732	9	36		
25	15	9.008586	10.991414	9.010857	10.989143	10.002271	9.997729	45	35		
26	30	9.008894	10.991106	9.011169	10.988831	10.002274	9.997726	30	34		
27	45	9.009202	10.990798	9.011479	10.988521	10.002277	9.997723	15	33		
28	52	9.009510	10.990490	9.011790	10.988210	10.002281	9.997719	8	32		
29	15	9.009817	10.990183	9.012101	10.987899	10.002284	9.997716	45	31		
30	30	9.010124	10.989876	9.012411	10.987589	10.002287	9.997713	30	30		
31	45	9.010431	10.989569	9.012721	10.987279	10.002290	9.997710	15	29		
32	53	9.010737	10.989263	9.013031	10.986969	10.002294	9.997706	7	28		
33	15	9.011044	10.988956	9.013341	10.986659	10.002297	9.997703	45	27		
34	30	9.011350	10.988650	9.013650	10.986350	10.002300	9.997700	30	26		
35	45	9.011656	10.988344	9.013959	10.986041	10.002303	9.997697	15	25		
36	54	9.011962	10.988038	9.014268	10.985732	10.002307	9.997693	6	24		
37	15	9.012267	10.987733	9.014577	10.985423	10.002310	9.997690	45	23		
38	30	9.012572	10.987428	9.014886	10.985114	10.002313	9.997687	30	22		
39	45	9.012877	10.987123	9.015194	10.984806	10.002317	9.997683	15	21		
40	55	9.013182	10.986818	9.015502	10.984498	10.002320	9.997680	5	20		
41	15	9.013487	10.986513	9.015810	10.984190	10.002323	9.997677	45	19		
42	30	9.013791	10.986209	9.016118	10.983882	10.002326	9.997674	30	18		
43	45	9.014096	10.985904	9.016425	10.983575	10.002330	9.997670	15	17		
44	56	9.014400	10.985600	9.016732	10.983268	10.002333	9.997667	4	16		
45	15	9.014703	10.985297	9.017039	10.982961	10.002336	9.997664	45	15		
46	30	9.015007	10.984993	9.017346	10.982654	10.002339	9.997661	30	14		
47	45	9.015310	10.984690	9.017653	10.982347	10.002343	9.997657	15	13		
48	57	9.015613	10.984387	9.017959	10.982041	10.002346	9.997654	3	12		
49	15	9.015916	10.984084	9.018266	10.981734	10.002349	9.997651	45	11		
50	30	9.016219	10.983781	9.018572	10.981428	10.002353	9.997647	30	10		
51	45	9.016522	10.983478	9.018877	10.981123	10.002356	9.997644	15	9		
52	58	9.016824	10.983176	9.019183	10.980817	10.002359	9.997641	2	8		
53	15	9.017126	10.982874	9.019488	10.980512	10.002363	9.997637	45	7		
54	30	9.017428	10.982572	9.019794	10.980206	10.002366	9.997634	30	6		
55	45	9.017729	10.982271	9.020099	10.979901	10.002369	9.997631	15	5		
56	59	9.018031	10.981969	9.020403	10.979597	10.002372	9.997628	1	4		
57	15	9.018332	10.981668	9.020708	10.979292	10.002376	9.997624	45	3		
58	30	9.018633	10.981367	9.021012	10.978988	10.002379	9.997621	30	2		
59	45	9.018934	10.981066	9.021316	10.978684	10.002382	9.997618	15	1		
60	60	9.019235	10.980765	9.021620	10.978380	10.002386	9.997614	0	0		
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.		
5 ^h 36 ^m .			LOG SINES, &c.				84 deg.				

0 ^h 24 ^m .		LOG. SINES, &c. (t.)						6 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.019235	10.980765	9.021620	10.978380	10.002386	9.997614	60	60
1	15	9.019535	10.980465	9.021924	10.978076	10.002389	9.997611	45	59
2	30	9.019835	10.980165	9.022227	10.977773	10.002392	9.997608	30	58
3	45	9.020135	10.979865	9.022531	10.977469	10.002396	9.997604	15	57
4	1	9.020435	10.979565	9.022834	10.977166	10.002399	9.997601	59	56
5	15	9.020734	10.979266	9.023137	10.976863	10.002402	9.997598	45	55
6	30	9.021034	10.978966	9.023439	10.976561	10.002406	9.997595	30	54
7	45	9.021333	10.978667	9.023742	10.976258	10.002409	9.997591	15	53
8	2	9.021632	10.978368	9.024044	10.975956	10.002412	9.997588	58	52
9	15	9.021930	10.978070	9.024346	10.975654	10.002416	9.997584	45	51
10	30	9.022229	10.977771	9.024648	10.975352	10.002419	9.997581	30	50
11	45	9.022527	10.977473	9.024950	10.975050	10.002422	9.997578	15	49
12	3	9.022825	10.977175	9.025251	10.974749	10.002426	9.997574	57	48
13	15	9.023123	10.976877	9.025552	10.974448	10.002429	9.997571	45	47
14	30	9.023421	10.976579	9.025853	10.974147	10.002432	9.997568	30	46
15	45	9.023718	10.976282	9.026154	10.973846	10.002436	9.997564	15	45
16	4	9.024016	10.975984	9.026455	10.973545	10.002439	9.997561	56	44
17	15	9.024313	10.975687	9.026755	10.973245	10.002442	9.997558	45	43
18	30	9.024610	10.975390	9.027055	10.972945	10.002446	9.997554	30	42
19	45	9.024906	10.975094	9.027355	10.972645	10.002449	9.997551	15	41
20	5	9.025203	10.974797	9.027655	10.972345	10.002453	9.997547	55	40
21	15	9.025499	10.974501	9.027955	10.972045	10.002456	9.997544	45	39
22	30	9.025795	10.974205	9.028254	10.971746	10.002459	9.997541	30	38
23	45	9.026091	10.973909	9.028553	10.971447	10.002463	9.997537	15	37
24	6	9.026386	10.973614	9.028852	10.971148	10.002466	9.997534	54	36
25	15	9.026682	10.973318	9.029151	10.970849	10.002469	9.997531	45	35
26	30	9.026977	10.973023	9.029450	10.970550	10.002473	9.997527	30	34
27	45	9.027272	10.972728	9.029748	10.970252	10.002476	9.997524	15	33
28	7	9.027567	10.972433	9.030046	10.969954	10.002480	9.997520	53	32
29	15	9.027862	10.972138	9.030344	10.969656	10.002483	9.997517	45	31
30	30	9.028156	10.971844	9.030642	10.969358	10.002486	9.997514	30	30
31	45	9.028450	10.971550	9.030940	10.969060	10.002490	9.997510	15	29
32	8	9.028744	10.971256	9.031237	10.968763	10.002493	9.997507	52	28
33	15	9.029038	10.970962	9.031534	10.968466	10.002497	9.997503	45	27
34	30	9.029332	10.970668	9.031831	10.968169	10.002500	9.997500	30	26
35	45	9.029625	10.970375	9.032128	10.967872	10.002503	9.997497	15	25
36	9	9.029918	10.970082	9.032425	10.967575	10.002507	9.997493	51	24
37	15	9.030211	10.969789	9.032721	10.967279	10.002510	9.997490	45	23
38	30	9.030504	10.969496	9.033017	10.966983	10.002514	9.997486	30	22
39	45	9.030797	10.969203	9.033313	10.966687	10.002517	9.997483	15	21
40	10	9.031089	10.968911	9.033609	10.966391	10.002520	9.997480	50	20
41	15	9.031381	10.968619	9.033905	10.966095	10.002524	9.997476	45	19
42	30	9.031673	10.968327	9.034200	10.965800	10.002527	9.997473	30	18
43	45	9.031965	10.968035	9.034496	10.965504	10.002531	9.997469	15	17
44	11	9.032257	10.967743	9.034791	10.965209	10.002534	9.997466	49	16
45	15	9.032548	10.967452	9.035085	10.964915	10.002537	9.997463	45	15
46	30	9.032839	10.967161	9.035380	10.964620	10.002541	9.997459	30	14
47	45	9.033130	10.966870	9.035675	10.964325	10.002544	9.997456	15	13
48	12	9.033421	10.966579	9.035969	10.964031	10.002548	9.997452	48	12
49	15	9.033712	10.966288	9.036263	10.963737	10.002551	9.997449	45	11
50	30	9.034002	10.965998	9.036557	10.963443	10.002555	9.997445	30	10
51	45	9.034292	10.965708	9.036850	10.963150	10.002558	9.997442	15	9
52	13	9.034582	10.965418	9.037144	10.962856	10.002561	9.997439	47	8
53	15	9.034872	10.965128	9.037437	10.962563	10.002565	9.997435	45	7
54	30	9.035162	10.964838	9.037730	10.962270	10.002568	9.997432	30	6
55	45	9.035451	10.964549	9.038023	10.961977	10.002572	9.997428	15	5
56	14	9.035741	10.964259	9.038316	10.961684	10.002575	9.997425	46	4
57	15	9.036030	10.963970	9.038608	10.961392	10.002579	9.997421	45	3
58	30	9.036319	10.963681	9.038901	10.961099	10.002582	9.997418	30	2
59	45	9.036607	10.963393	9.039193	10.960807	10.002586	9.997414	15	1
60	15	9.036896	10.963104	9.039485	10.960515	10.002589	9.997411	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
5 ^h 35 ^m .		LOG. SINES, &c.						83 deg.	

0 ^h 25 ^m .		LOG. SINES, &c. (t.)						6 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.036896	10.963104	9.039485	10.960515	10.002589	9.997411	45	60
1	15	9.037184	10.962816	9.039776	10.960224	10.002593	9.997407	45	59
2	30	9.037472	10.962528	9.040068	10.959932	10.002596	9.997404	30	58
3	45	9.037760	10.962240	9.040359	10.959641	10.002599	9.997401	15	57
4	16	9.038048	10.961952	9.040651	10.959349	10.002603	9.997397	44	56
5	15	9.038335	10.961665	9.040942	10.959058	10.002606	9.997394	45	55
6	30	9.038623	10.961377	9.041232	10.958768	10.002610	9.997390	30	54
7	45	9.038910	10.961090	9.041523	10.958477	10.002613	9.997387	15	53
8	17	9.039197	10.960803	9.041813	10.958187	10.002617	9.997383	43	52
9	15	9.039483	10.960517	9.042104	10.957896	10.002620	9.997380	45	51
10	30	9.039770	10.960230	9.042394	10.957606	10.002624	9.997376	30	50
11	45	9.040056	10.959944	9.042683	10.957317	10.002627	9.997373	15	49
12	18	9.040342	10.959658	9.042973	10.957027	10.002631	9.997369	42	48
13	15	9.040628	10.959372	9.043263	10.956737	10.002634	9.997366	45	47
14	30	9.040914	10.959086	9.043552	10.956448	10.002638	9.997362	30	46
15	45	9.041200	10.958800	9.043841	10.956159	10.002641	9.997359	15	45
16	19	9.041485	10.958515	9.044130	10.955870	10.002645	9.997355	41	44
17	15	9.041770	10.958230	9.044419	10.955581	10.002648	9.997352	45	43
18	30	9.042055	10.957945	9.044707	10.955293	10.002652	9.997348	30	42
19	45	9.042340	10.957660	9.044995	10.955005	10.002655	9.997345	15	41
20	20	9.042625	10.957375	9.045284	10.954716	10.002659	9.997341	40	40
21	15	9.042909	10.957091	9.045572	10.954428	10.002662	9.997338	45	39
22	30	9.043194	10.956806	9.045859	10.954141	10.002666	9.997334	30	38
23	45	9.043478	10.956522	9.046147	10.953853	10.002669	9.997331	15	37
24	21	9.043762	10.956238	9.046434	10.953566	10.002673	9.997327	39	36
25	15	9.044045	10.955955	9.046722	10.953278	10.002676	9.997324	45	35
26	30	9.044329	10.955671	9.047009	10.952991	10.002680	9.997320	30	34
27	45	9.044612	10.955388	9.047295	10.952705	10.002683	9.997317	15	33
28	22	9.044895	10.955105	9.047582	10.952418	10.002687	9.997313	38	32
29	15	9.045178	10.954822	9.047869	10.952131	10.002690	9.997310	45	31
30	30	9.045461	10.954539	9.048155	10.951845	10.002694	9.997306	30	30
31	45	9.045744	10.954256	9.048441	10.951559	10.002697	9.997303	15	29
32	23	9.046026	10.953974	9.048727	10.951273	10.002701	9.997299	37	28
33	15	9.046308	10.953692	9.049013	10.950987	10.002704	9.997296	45	27
34	30	9.046590	10.953410	9.049298	10.950702	10.002708	9.997292	30	26
35	45	9.046872	10.953128	9.049584	10.950416	10.002712	9.997288	15	25
36	24	9.047154	10.952846	9.049869	10.950131	10.002715	9.997285	36	24
37	15	9.047435	10.952565	9.050154	10.949846	10.002719	9.997281	45	23
38	30	9.047717	10.952283	9.050439	10.949561	10.002722	9.997278	30	22
39	45	9.047998	10.952002	9.050723	10.949277	10.002726	9.997274	15	21
40	25	9.048279	10.951721	9.051008	10.948992	10.002729	9.997271	35	20
41	15	9.048559	10.951441	9.051292	10.948708	10.002733	9.997267	45	19
42	30	9.048840	10.951160	9.051576	10.948424	10.002736	9.997264	30	18
43	45	9.049120	10.950880	9.051860	10.948140	10.002740	9.997260	15	17
44	26	9.049400	10.950600	9.052144	10.947856	10.002743	9.997257	34	16
45	15	9.049680	10.950320	9.052427	10.947573	10.002747	9.997253	45	15
46	30	9.049960	10.950040	9.052711	10.947289	10.002751	9.997249	30	14
47	45	9.050240	10.949760	9.052994	10.947006	10.002754	9.997246	15	13
48	27	9.050519	10.949481	9.053277	10.946723	10.002758	9.997242	33	12
49	15	9.050799	10.949201	9.053560	10.946440	10.002761	9.997239	45	11
50	30	9.051078	10.948922	9.053843	10.946157	10.002765	9.997235	30	10
51	45	9.051357	10.948643	9.054125	10.945875	10.002768	9.997232	15	9
52	28	9.051635	10.948365	9.054407	10.945593	10.002772	9.997228	32	8
53	15	9.051914	10.948086	9.054689	10.945311	10.002776	9.997224	45	7
54	30	9.052192	10.947808	9.054971	10.945029	10.002779	9.997221	30	6
55	45	9.052470	10.947530	9.055253	10.944747	10.002783	9.997217	15	5
56	29	9.052748	10.947252	9.055535	10.944465	10.002786	9.997214	31	4
57	15	9.053026	10.946974	9.055816	10.944184	10.002790	9.997210	45	3
58	30	9.053304	10.946696	9.056097	10.943903	10.002794	9.997206	30	2
59	45	9.053581	10.946419	9.056379	10.943621	10.002797	9.997203	15	1
60	30	9.053859	10.946141	9.056659	10.943341	10.002801	9.997199	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 34 ^m .		LOG. SINES, &c.						83 deg.	

0 ^h 26 ^m .		LOG. SINES, &c. (t.)						6 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.053859	10.946141	9.056659	10.943341	10.002801	9.997199	30	60
1	15	9.054136	10.945864	9.056940	10.943060	10.002804	9.997196	45	59
2	30	9.054413	10.945587	9.057221	10.942779	10.002808	9.997192	30	58
3	45	9.054689	10.945311	9.057501	10.942499	10.002812	9.997188	15	57
4	31	9.054966	10.945034	9.057781	10.942219	10.002815	9.997185	29	56
5	15	9.055242	10.944758	9.058061	10.941939	10.002819	9.997181	45	55
6	30	9.055519	10.944481	9.058341	10.941659	10.002822	9.997178	30	54
7	45	9.055795	10.944205	9.058621	10.941379	10.002826	9.997174	15	53
8	32	9.056071	10.943929	9.058900	10.941100	10.002830	9.997170	28	52
9	15	9.056346	10.943654	9.059179	10.940821	10.002833	9.997167	45	51
10	30	9.056622	10.943378	9.059459	10.940541	10.002837	9.997163	30	50
11	45	9.056897	10.943103	9.059738	10.940262	10.002840	9.997160	15	49
12	33	9.057172	10.942828	9.060016	10.939984	10.002844	9.997156	27	48
13	15	9.057447	10.942553	9.060295	10.939705	10.002848	9.997152	45	47
14	30	9.057722	10.942278	9.060573	10.939427	10.002851	9.997149	30	46
15	45	9.057997	10.942003	9.060852	10.939148	10.002855	9.997145	15	45
16	34	9.058271	10.941729	9.061130	10.938870	10.002859	9.997141	26	44
17	15	9.058545	10.941455	9.061408	10.938592	10.002862	9.997138	45	43
18	30	9.058819	10.941181	9.061685	10.938315	10.002866	9.997134	30	42
19	45	9.059093	10.940907	9.061963	10.938037	10.002870	9.997130	15	41
20	35	9.059367	10.940633	9.062240	10.937760	10.002873	9.997127	25	40
21	15	9.059641	10.940359	9.062518	10.937482	10.002877	9.997123	45	39
22	30	9.059914	10.940086	9.062795	10.937205	10.002880	9.997120	30	38
23	45	9.060187	10.939813	9.063071	10.936929	10.002884	9.997116	15	37
24	36	9.060460	10.939540	9.063348	10.936652	10.002888	9.997112	24	36
25	15	9.060733	10.939267	9.063625	10.936375	10.002891	9.997109	45	35
26	30	9.061006	10.938994	9.063901	10.936099	10.002895	9.997105	30	34
27	45	9.061278	10.938722	9.064177	10.935823	10.002899	9.997101	15	33
28	37	9.061551	10.938449	9.064453	10.935547	10.002902	9.997098	23	32
29	15	9.061823	10.938177	9.064729	10.935271	10.002906	9.997094	45	31
30	30	9.062095	10.937905	9.065005	10.934995	10.002910	9.997090	30	30
31	45	9.062367	10.937633	9.065280	10.934720	10.002913	9.997087	15	29
32	38	9.062639	10.937361	9.065556	10.934444	10.002917	9.997083	22	28
33	15	9.062910	10.937090	9.065831	10.934169	10.002921	9.997079	45	27
34	30	9.063181	10.936819	9.066106	10.933894	10.002924	9.997076	30	26
35	45	9.063452	10.936548	9.066381	10.933619	10.002928	9.997072	15	25
36	39	9.063723	10.936277	9.066655	10.933345	10.002932	9.997068	21	24
37	15	9.063994	10.936006	9.066930	10.933070	10.002936	9.997064	45	23
38	30	9.064265	10.935735	9.067204	10.932796	10.002939	9.997061	30	22
39	45	9.064535	10.935465	9.067478	10.932522	10.002943	9.997057	15	21
40	40	9.064806	10.935194	9.067752	10.932248	10.002947	9.997053	20	20
41	15	9.065076	10.934924	9.068026	10.931974	10.002950	9.997050	45	19
42	30	9.065346	10.934654	9.068300	10.931700	10.002954	9.997046	30	18
43	45	9.065616	10.934384	9.068573	10.931427	10.002958	9.997042	15	17
44	41	9.065885	10.934115	9.068846	10.931154	10.002961	9.997039	19	16
45	15	9.066155	10.933845	9.069120	10.930880	10.002965	9.997035	45	15
46	30	9.066424	10.933576	9.069393	10.930607	10.002969	9.997031	30	14
47	45	9.066693	10.933307	9.069665	10.930335	10.002972	9.997028	15	13
48	42	9.066962	10.933038	9.069938	10.930062	10.002976	9.997024	18	12
49	15	9.067231	10.932769	9.070210	10.929790	10.002980	9.997020	45	11
50	30	9.067499	10.932501	9.070483	10.929517	10.002984	9.997016	30	10
51	45	9.067768	10.932232	9.070755	10.929245	10.002987	9.997013	15	9
52	43	9.068036	10.931964	9.071027	10.928973	10.002991	9.997009	17	8
53	15	9.068304	10.931696	9.071299	10.928701	10.002995	9.997005	45	7
54	30	9.068572	10.931428	9.071570	10.928430	10.002998	9.997002	30	6
55	45	9.068840	10.931160	9.071842	10.928158	10.003002	9.996998	15	5
56	44	9.069107	10.930893	9.072113	10.927887	10.003006	9.996994	16	4
57	15	9.069375	10.930625	9.072384	10.927616	10.003010	9.996990	45	3
58	30	9.069642	10.930358	9.072655	10.927345	10.003013	9.996987	30	2
59	45	9.069909	10.930091	9.072926	10.927074	10.003017	9.996983	15	1
60	45	9.070176	10.929824	9.073197	10.926803	10.003021	9.996979	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 33 ^m .		LOG. SINES, &c.						83 deg.	

0 ^h 27 ^m .		LOG. SINES, &c. (t.)						6 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.070176	10.929824	9.073197	10.926803	10.003021	9.996979	15	60
1	15	9.070443	10.929557	9.073467	10.926533	10.003025	9.996975	45	59
2	30	9.070709	10.929291	9.073738	10.926262	10.003028	9.996972	30	58
3	45	9.070976	10.929024	9.074008	10.925992	10.003032	9.996968	15	57
4	46	9.071242	10.928758	9.074278	10.925722	10.003036	9.996964	14	56
5	15	9.071508	10.928492	9.074548	10.925452	10.003040	9.996960	45	55
6	30	9.071774	10.928226	9.074817	10.925183	10.003043	9.996957	30	54
7	45	9.072040	10.927960	9.075087	10.924913	10.003047	9.996953	15	53
8	47	9.072305	10.927695	9.075356	10.924644	10.003051	9.996949	13	52
9	15	9.072571	10.927429	9.075625	10.924375	10.003055	9.996945	45	51
10	30	9.072836	10.927164	9.075894	10.924106	10.003058	9.996942	30	50
11	45	9.073101	10.926899	9.076163	10.923837	10.003062	9.996938	15	49
12	48	9.073366	10.926634	9.076432	10.923568	10.003066	9.996934	12	48
13	15	9.073631	10.926369	9.076701	10.923299	10.003070	9.996930	45	47
14	30	9.073896	10.926104	9.076969	10.923031	10.003073	9.996927	30	46
15	45	9.074160	10.925840	9.077237	10.922763	10.003077	9.996923	15	45
16	49	9.074424	10.925576	9.077505	10.922495	10.003081	9.996919	11	44
17	15	9.074688	10.925312	9.077773	10.922227	10.003085	9.996915	45	43
18	30	9.074952	10.925048	9.078041	10.921959	10.003089	9.996911	30	42
19	45	9.075216	10.924784	9.078308	10.921692	10.003092	9.996908	15	41
20	50	9.075480	10.924520	9.078576	10.921424	10.003096	9.996904	10	40
21	15	9.075743	10.924257	9.078843	10.921157	10.003100	9.996900	45	39
22	30	9.076007	10.923993	9.079110	10.920890	10.003104	9.996896	30	38
23	45	9.076270	10.923730	9.079377	10.920623	10.003107	9.996893	15	37
24	51	9.076533	10.923467	9.079644	10.920356	10.003111	9.996889	9	36
25	15	9.076796	10.923204	9.079911	10.920089	10.003115	9.996885	45	35
26	30	9.077058	10.922942	9.080177	10.919823	10.003119	9.996881	30	34
27	45	9.077321	10.922679	9.080443	10.919557	10.003123	9.996877	15	33
28	52	9.077583	10.922417	9.080710	10.919290	10.003126	9.996874	8	32
29	15	9.077845	10.922155	9.080976	10.919024	10.003130	9.996870	45	31
30	30	9.078107	10.921893	9.081241	10.918759	10.003134	9.996866	30	30
31	45	9.078369	10.921631	9.081507	10.918493	10.003138	9.996862	15	29
32	53	9.078631	10.921369	9.081773	10.918227	10.003142	9.996858	7	28
33	15	9.078892	10.921108	9.082038	10.917962	10.003145	9.996855	45	27
34	30	9.079154	10.920846	9.082303	10.917697	10.003149	9.996851	30	26
35	45	9.079415	10.920585	9.082568	10.917432	10.003153	9.996847	15	25
36	54	9.079676	10.920324	9.082833	10.917167	10.003157	9.996843	6	24
37	15	9.079937	10.920063	9.083098	10.916902	10.003161	9.996839	45	23
38	30	9.080198	10.919802	9.083362	10.916638	10.003165	9.996835	30	22
39	45	9.080458	10.919542	9.083627	10.916373	10.003168	9.996832	15	21
40	55	9.080719	10.919281	9.083891	10.916109	10.003172	9.996828	5	20
41	15	9.080979	10.919021	9.084155	10.915845	10.003176	9.996824	45	19
42	30	9.081239	10.918761	9.084419	10.915581	10.003180	9.996820	30	18
43	45	9.081499	10.918501	9.084683	10.915317	10.003184	9.996816	15	17
44	56	9.081759	10.918241	9.084947	10.915053	10.003188	9.996812	4	16
45	15	9.082019	10.917981	9.085210	10.914790	10.003191	9.996809	45	15
46	30	9.082278	10.917722	9.085473	10.914527	10.003195	9.996805	30	14
47	45	9.082537	10.917463	9.085736	10.914264	10.003199	9.996801	15	13
48	57	9.082797	10.917203	9.086000	10.914000	10.003203	9.996797	3	12
49	15	9.083056	10.916944	9.086262	10.913738	10.003207	9.996793	45	11
50	30	9.083314	10.916686	9.086525	10.913475	10.003211	9.996789	30	10
51	45	9.083573	10.916427	9.086788	10.913212	10.003215	9.996785	15	9
52	58	9.083832	10.916168	9.087050	10.912950	10.003218	9.996782	2	8
53	15	9.084090	10.915910	9.087312	10.912688	10.003222	9.996778	45	7
54	30	9.084348	10.915652	9.087574	10.912426	10.003226	9.996774	30	6
55	45	9.084606	10.915394	9.087836	10.912164	10.003230	9.996770	15	5
56	59	9.084864	10.915136	9.088098	10.911902	10.003234	9.996766	1	4
57	15	9.085122	10.914878	9.088360	10.911640	10.003238	9.996762	45	3
58	30	9.085380	10.914620	9.088621	10.911379	10.003242	9.996758	30	2
59	45	9.085637	10.914363	9.088883	10.911117	10.003245	9.996755	15	1
60	60	9.085894	10.914106	9.089144	10.910856	10.003249	9.996751	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 32 ^m .		LOG. SINES, &c.						83 deg.	

0 ^h 28 ^m .			LOG. SINES, &c. (t.)				7 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.085894	10.914106	9.089144	10.910856	10.003249	9.996751	60	60
1	15	9.086152	10.913848	9.089405	10.910595	10.003253	9.996747	45	59
2	30	9.086409	10.913591	9.089666	10.910334	10.003257	9.996743	30	58
3	45	9.086665	10.913335	9.089926	10.910074	10.003261	9.996739	15	57
4	1	9.086922	10.913078	9.090187	10.909813	10.003265	9.996735	59	56
5	15	9.087179	10.912821	9.090447	10.909553	10.003269	9.996731	45	55
6	30	9.087435	10.912565	9.090708	10.909292	10.003273	9.996727	30	54
7	45	9.087691	10.912309	9.090968	10.909032	10.003277	9.996723	15	53
8	2	9.087947	10.912053	9.091228	10.908772	10.003280	9.996720	58	52
9	15	9.088203	10.911797	9.091487	10.908513	10.003284	9.996716	45	51
10	30	9.088459	10.911541	9.091747	10.908253	10.003288	9.996712	30	50
11	45	9.088715	10.911285	9.092007	10.907993	10.003292	9.996708	15	49
12	3	9.088970	10.911030	9.092266	10.907734	10.003296	9.996704	57	48
13	15	9.089225	10.910775	9.092525	10.907475	10.003300	9.996700	45	47
14	30	9.089480	10.910520	9.092784	10.907216	10.003304	9.996696	30	46
15	45	9.089735	10.910265	9.093043	10.906957	10.003308	9.996692	15	45
16	4	9.089990	10.910010	9.093302	10.906698	10.003312	9.996688	56	44
17	15	9.090245	10.909755	9.093561	10.906439	10.003316	9.996684	45	43
18	30	9.090500	10.909500	9.093819	10.906181	10.003320	9.996680	30	42
19	45	9.090754	10.909246	9.094077	10.905923	10.003323	9.996677	15	41
20	5	9.091008	10.908992	9.094335	10.905665	10.003327	9.996673	55	40
21	15	9.091262	10.908738	9.094593	10.905407	10.003331	9.996669	45	39
22	30	9.091516	10.908484	9.094851	10.905149	10.003335	9.996665	30	38
23	45	9.091770	10.908230	9.095109	10.904891	10.003339	9.996661	15	37
24	6	9.092024	10.907976	9.095367	10.904633	10.003343	9.996657	54	36
25	15	9.092277	10.907723	9.095624	10.904376	10.003347	9.996653	45	35
26	30	9.092530	10.907470	9.095881	10.904119	10.003351	9.996649	30	34
27	45	9.092784	10.907216	9.096138	10.903862	10.003355	9.996645	15	33
28	7	9.093037	10.906963	9.096395	10.903605	10.003359	9.996641	53	32
29	15	9.093290	10.906710	9.096652	10.903348	10.003363	9.996637	45	31
30	30	9.093542	10.906458	9.096909	10.903091	10.003367	9.996633	30	30
31	45	9.093795	10.906205	9.097165	10.902835	10.003371	9.996629	15	29
32	8	9.094047	10.905953	9.097422	10.902578	10.003375	9.996625	52	28
33	15	9.094300	10.905700	9.097678	10.902322	10.003379	9.996621	45	27
34	30	9.094552	10.905448	9.097934	10.902066	10.003383	9.996617	30	26
35	45	9.094804	10.905196	9.098190	10.901810	10.003386	9.996614	15	25
36	9	9.095056	10.904944	9.098446	10.901554	10.003390	9.996610	51	24
37	15	9.095307	10.904693	9.098702	10.901298	10.003394	9.996606	45	23
38	30	9.095559	10.904441	9.098957	10.901043	10.003398	9.996602	30	22
39	45	9.095810	10.904190	9.099213	10.900787	10.003402	9.996598	15	21
40	10	9.096061	10.903939	9.099468	10.900532	10.003406	9.996594	50	20
41	15	9.096313	10.903687	9.099723	10.900277	10.003410	9.996590	45	19
42	30	9.096564	10.903436	9.099978	10.900022	10.003414	9.996586	30	18
43	45	9.096814	10.903186	9.100233	10.899767	10.003418	9.996582	15	17
44	11	9.097065	10.902935	9.100487	10.899513	10.003422	9.996578	49	16
45	15	9.097316	10.902684	9.100742	10.899258	10.003426	9.996574	45	15
46	30	9.097566	10.902434	9.100996	10.899004	10.003430	9.996570	30	14
47	45	9.097816	10.902184	9.101250	10.898750	10.003434	9.996566	15	13
48	12	9.098066	10.901934	9.101504	10.898496	10.003438	9.996562	48	12
49	15	9.098316	10.901684	9.101758	10.898242	10.003442	9.996558	45	11
50	30	9.098566	10.901434	9.102012	10.897988	10.003446	9.996554	30	10
51	45	9.098816	10.901184	9.102266	10.897734	10.003450	9.996550	15	9
52	13	9.099065	10.900935	9.102519	10.897481	10.003454	9.996546	47	8
53	15	9.099314	10.900686	9.102772	10.897228	10.003458	9.996542	45	7
54	30	9.099564	10.900436	9.103026	10.896974	10.003462	9.996538	30	6
55	45	9.099813	10.900187	9.103279	10.896721	10.003466	9.996534	15	5
56	14	9.100032	10.899938	9.103532	10.896468	10.003470	9.996530	46	4
57	15	9.100310	10.899690	9.103784	10.896216	10.003474	9.996526	45	3
58	30	9.100559	10.899441	9.104037	10.895963	10.003478	9.996522	30	2
59	45	9.100807	10.899193	9.104290	10.895710	10.003482	9.996518	15	1
60	15	9.101056	10.898944	9.104542	10.895458	10.003486	9.996514	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 31 ^m .			LOG. SINES, &c.				82 deg.		

0 ^h 29 ^m .			LOG. SINES, &c. (t)						7 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	15	9.101056	10.898944	9.104542	10.895458	10.003486	9.996514	45		60	
1	15	9.101304	10.898696	9.104794	10.895206	10.003490	9.996510	45		59	
2	30	9.101552	10.898448	9.105046	10.894954	10.003494	9.996506	30		58	
3	45	9.101800	10.898200	9.105298	10.894702	10.003498	9.996502	15		57	
4	16	9.102048	10.897952	9.105550	10.894450	10.003502	9.996498	44		56	
5	15	9.102295	10.897705	9.105802	10.894198	10.003506	9.996494	45		55	
6	30	9.102543	10.897457	9.106053	10.893947	10.003510	9.996490	30		54	
7	45	9.102790	10.897210	9.106304	10.893696	10.003514	9.996486	15		53	
8	17	9.103037	10.896963	9.106556	10.893444	10.003518	9.996482	43		52	
9	15	9.103284	10.896716	9.106807	10.893193	10.003522	9.996478	45		51	
10	30	9.103531	10.896469	9.107058	10.892942	10.003527	9.996473	30		50	
11	45	9.103778	10.896222	9.107309	10.892692	10.003531	9.996469	15		49	
12	18	9.104025	10.895975	9.107559	10.892441	10.003535	9.996465	42		48	
13	15	9.104271	10.895729	9.107810	10.892190	10.003539	9.996461	45		47	
14	30	9.104517	10.895483	9.108060	10.891940	10.003543	9.996457	30		46	
15	45	9.104764	10.895236	9.108310	10.891690	10.003547	9.996453	15		45	
16	19	9.105010	10.894990	9.108560	10.891440	10.003551	9.996449	41		44	
17	15	9.105255	10.894745	9.108810	10.891190	10.003555	9.996445	45		43	
18	30	9.105501	10.894499	9.109060	10.890940	10.003559	9.996441	30		42	
19	45	9.105747	10.894253	9.109310	10.890690	10.003563	9.996437	15		41	
20	20	9.105992	10.894008	9.109559	10.890441	10.003567	9.996433	40		40	
21	15	9.106238	10.893762	9.109809	10.890191	10.003571	9.996429	45		39	
22	30	9.106483	10.893517	9.110058	10.889942	10.003575	9.996425	30		38	
23	45	9.106728	10.893272	9.110307	10.889693	10.003579	9.996421	15		37	
24	21	9.106973	10.893027	9.110556	10.889444	10.003583	9.996417	39		36	
25	15	9.107218	10.892782	9.110805	10.889195	10.003587	9.996413	45		35	
26	30	9.107462	10.892538	9.111054	10.888946	10.003591	9.996409	30		34	
27	45	9.107707	10.892293	9.111302	10.888696	10.003596	9.996404	15		33	
28	22	9.107951	10.892049	9.111551	10.888449	10.003600	9.996400	38		32	
29	15	9.108195	10.891805	9.111799	10.888201	10.003604	9.996396	45		31	
30	30	9.108439	10.891561	9.112047	10.887953	10.003608	9.996392	30		30	
31	45	9.108683	10.891317	9.112295	10.887705	10.003612	9.996388	15		29	
32	23	9.108927	10.891073	9.112543	10.887457	10.003616	9.996384	37		28	
33	15	9.109171	10.890829	9.112791	10.887209	10.003620	9.996380	45		27	
34	30	9.109414	10.890586	9.113038	10.886962	10.003624	9.996376	30		26	
35	45	9.109658	10.890342	9.113286	10.886714	10.003628	9.996372	15		25	
36	24	9.109901	10.890099	9.113533	10.886467	10.003632	9.996368	36		24	
37	15	9.110144	10.889856	9.113780	10.886220	10.003636	9.996364	45		23	
38	30	9.110387	10.889613	9.114028	10.885972	10.003641	9.996359	30		22	
39	45	9.110630	10.889370	9.114274	10.885726	10.003645	9.996355	15		21	
40	25	9.110873	10.889127	9.114521	10.885479	10.003649	9.996351	35		20	
41	15	9.111115	10.888885	9.114768	10.885232	10.003653	9.996347	45		19	
42	30	9.111358	10.888642	9.115014	10.884986	10.003657	9.996343	30		18	
43	45	9.111600	10.888400	9.115261	10.884739	10.003661	9.996339	15		17	
44	26	9.111842	10.888158	9.115507	10.884493	10.003665	9.996335	34		16	
45	15	9.112084	10.887916	9.115753	10.884247	10.003669	9.996331	45		15	
46	30	9.112326	10.887674	9.115999	10.884001	10.003674	9.996326	30		14	
47	45	9.112568	10.887432	9.116245	10.883755	10.003678	9.996322	15		13	
48	27	9.112809	10.887191	9.116491	10.883509	10.003682	9.996318	33		12	
49	15	9.113051	10.886949	9.116736	10.883264	10.003686	9.996314	45		11	
50	30	9.113292	10.886708	9.116982	10.883018	10.003690	9.996310	30		10	
51	45	9.113533	10.886467	9.117227	10.882773	10.003694	9.996306	15		9	
52	28	9.113774	10.886226	9.117472	10.882528	10.003698	9.996302	32		8	
53	15	9.114015	10.885985	9.117717	10.882283	10.003702	9.996298	45		7	
54	30	9.114256	10.885744	9.117962	10.882038	10.003707	9.996293	30		6	
55	45	9.114496	10.885504	9.118207	10.881793	10.003711	9.996289	15		5	
56	29	9.114737	10.885263	9.118452	10.881548	10.003715	9.996285	31		4	
57	15	9.114977	10.885023	9.118696	10.881304	10.003719	9.996281	45		3	
58	30	9.115218	10.884782	9.118941	10.881059	10.003723	9.996277	30		2	
59	45	9.115458	10.884542	9.119185	10.880815	10.003727	9.996273	15		1	
60	30	9.115698	10.884302	9.119429	10.880571	10.003731	9.996269	30		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
5 ^h 30 ^m .			LOG SINES, &c.				82 deg.				

0 ^h 30 ^m .		LOG. SINES, &c. (t.)						7 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.115698	10.884302	9.119429	10.880571	10.003731	9.996269	30	60
1	15	9.115937	10.884063	9.119673	10.880327	10.003736	9.996264	45	59
2	30	9.116177	10.883823	9.119917	10.880083	10.003740	9.996260	30	58
3	45	9.116417	10.883583	9.120161	10.879839	10.003744	9.996256	15	57
4	31	9.116656	10.883344	9.120404	10.879596	10.003748	9.996252	29	56
5	15	9.116895	10.883105	9.120648	10.879352	10.003752	9.996248	45	55
6	30	9.117135	10.882865	9.120891	10.879109	10.003756	9.996244	30	54
7	45	9.117374	10.882626	9.121134	10.878866	10.003761	9.996239	15	53
8	32	9.117612	10.882388	9.121377	10.878623	10.003765	9.996235	28	52
9	15	9.117851	10.882149	9.121620	10.878380	10.003769	9.996231	45	51
10	30	9.118090	10.881910	9.121863	10.878137	10.003773	9.996227	30	50
11	45	9.118328	10.881672	9.122106	10.877894	10.003777	9.996223	15	49
12	33	9.118567	10.881433	9.122348	10.877652	10.003782	9.996218	27	48
13	15	9.118805	10.881195	9.122591	10.877409	10.003786	9.996214	45	47
14	30	9.119043	10.880957	9.122833	10.877167	10.003790	9.996210	30	46
15	45	9.119281	10.880719	9.123075	10.876925	10.003794	9.996206	15	45
16	34	9.119519	10.880481	9.123317	10.876683	10.003798	9.996202	26	44
17	15	9.119756	10.880244	9.123559	10.876441	10.003803	9.996197	45	43
18	30	9.119994	10.880006	9.123801	10.876199	10.003807	9.996193	30	42
19	45	9.120231	10.879769	9.124042	10.875958	10.003811	9.996189	15	41
20	35	9.120469	10.879531	9.124284	10.875716	10.003815	9.996185	25	40
21	15	9.120706	10.879294	9.124525	10.875475	10.003819	9.996181	45	39
22	30	9.120943	10.879057	9.124766	10.875234	10.003824	9.996176	30	38
23	45	9.121180	10.878820	9.125008	10.874992	10.003828	9.996172	15	37
24	36	9.121417	10.878583	9.125249	10.874751	10.003832	9.996168	24	36
25	15	9.121653	10.878347	9.125489	10.874511	10.003836	9.996164	45	35
26	30	9.121890	10.878110	9.125730	10.874270	10.003840	9.996160	30	34
27	45	9.122126	10.877874	9.125971	10.874029	10.003845	9.996155	15	33
28	37	9.122362	10.877638	9.126211	10.873789	10.003849	9.996151	23	32
29	15	9.122598	10.877402	9.126451	10.873549	10.003853	9.996147	45	31
30	30	9.122834	10.877166	9.126692	10.873308	10.003857	9.996143	30	30
31	45	9.123070	10.876930	9.126932	10.873068	10.003862	9.996138	15	29
32	38	9.123306	10.876694	9.127172	10.872828	10.003866	9.996134	22	28
33	15	9.123542	10.876458	9.127412	10.872588	10.003870	9.996130	45	27
34	30	9.123777	10.876223	9.127651	10.872349	10.003874	9.996126	30	26
35	45	9.124012	10.875988	9.127891	10.872109	10.003878	9.996122	15	25
36	39	9.124248	10.875752	9.128130	10.871870	10.003883	9.996117	21	24
37	15	9.124483	10.875517	9.128370	10.871630	10.003887	9.996113	45	23
38	30	9.124718	10.875282	9.128609	10.871391	10.003891	9.996109	30	22
39	45	9.124952	10.875048	9.128848	10.871152	10.003895	9.996105	15	21
40	40	9.125187	10.874813	9.129087	10.870913	10.003900	9.996100	20	20
41	15	9.125422	10.874578	9.129326	10.870674	10.003904	9.996096	45	19
42	30	9.125656	10.874344	9.129564	10.870436	10.003908	9.996092	30	18
43	45	9.125890	10.874110	9.129803	10.870197	10.003912	9.996088	15	17
44	41	9.126125	10.873875	9.130041	10.869959	10.003917	9.996083	19	16
45	15	9.126359	10.873641	9.130280	10.869720	10.003921	9.996079	45	15
46	30	9.126593	10.873407	9.130518	10.869482	10.003925	9.996075	30	14
47	45	9.126826	10.873174	9.130756	10.869244	10.003929	9.996071	15	13
48	42	9.127060	10.872940	9.130994	10.869006	10.003934	9.996066	18	12
49	15	9.127294	10.872706	9.131231	10.868769	10.003938	9.996062	45	11
50	30	9.127527	10.872473	9.131469	10.868531	10.003942	9.996058	30	10
51	45	9.127760	10.872240	9.131707	10.868293	10.003947	9.996053	15	9
52	43	9.127993	10.872007	9.131944	10.868056	10.003951	9.996049	17	8
53	15	9.128226	10.871774	9.132181	10.867819	10.003955	9.996045	45	7
54	30	9.128459	10.871541	9.132419	10.867581	10.003959	9.996041	30	6
55	45	9.128692	10.871308	9.132656	10.867344	10.003964	9.996036	15	5
56	44	9.128925	10.871075	9.132893	10.867107	10.003968	9.996032	16	4
57	15	9.129157	10.870843	9.133129	10.866871	10.003972	9.996028	45	3
58	30	9.129390	10.870610	9.133366	10.866634	10.003977	9.996023	30	2
59	45	9.129622	10.870378	9.133603	10.866397	10.003981	9.996019	15	1
60	45	9.129854	10.870146	9.133839	10.866161	10.003985	9.996015	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 29 ^m .		LOG. SINES, &c.						82 deg.	

0 ^h 31 ^m .			LOG. SINES, &c. (t)						7 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	45	9.129854	10.870146	9.133839	10.866161	10.003985	9.996015	15		60	
1	15	9.130086	10.869914	9.134075	10.865925	10.003989	9.996011	45		59	
2	30	9.130318	10.869682	9.134311	10.865689	10.003994	9.996006	30		58	
3	45	9.130550	10.869450	9.134548	10.865452	10.003998	9.996002	15		57	
4	46	9.130781	10.869219	9.134783	10.865217	10.004002	9.995998	14		56	
5	15	9.131013	10.868987	9.135019	10.864981	10.004007	9.995993	45		55	
6	30	9.131244	10.868756	9.135255	10.864745	10.004011	9.995989	30		54	
7	45	9.131475	10.868525	9.135491	10.864509	10.004015	9.995985	15		53	
8	47	9.131706	10.868294	9.135726	10.864274	10.004020	9.995980	13		52	
9	15	9.131937	10.868063	9.135961	10.864039	10.004024	9.995976	45		51	
10	30	9.132168	10.867832	9.136196	10.863804	10.004028	9.995972	30		50	
11	45	9.132399	10.867601	9.136432	10.863568	10.004033	9.995967	15		49	
12	48	9.132630	10.867370	9.136666	10.863334	10.004037	9.995963	12		48	
13	15	9.132860	10.867140	9.136901	10.863099	10.004041	9.995959	45		47	
14	30	9.133091	10.866909	9.137136	10.862864	10.004046	9.995954	30		46	
15	45	9.133321	10.866679	9.137371	10.862629	10.004050	9.995950	15		45	
16	49	9.133551	10.866449	9.137605	10.862395	10.004054	9.995946	11		44	
17	15	9.133781	10.866219	9.137839	10.862161	10.004059	9.995941	45		43	
18	30	9.134011	10.865989	9.138074	10.861926	10.004063	9.995937	30		42	
19	45	9.134241	10.865759	9.138308	10.861692	10.004067	9.995933	15		41	
20	50	9.134470	10.865530	9.138542	10.861458	10.004072	9.995928	10		40	
21	15	9.134700	10.865300	9.138776	10.861224	10.004076	9.995924	45		39	
22	30	9.134929	10.865071	9.139009	10.860991	10.004080	9.995920	30		38	
23	45	9.135158	10.864842	9.139243	10.860757	10.004085	9.995915	15		37	
24	51	9.135387	10.864613	9.139476	10.860524	10.004089	9.995911	9		36	
25	15	9.135616	10.864384	9.139710	10.860290	10.004093	9.995907	45		35	
26	30	9.135845	10.864155	9.139943	10.860057	10.004098	9.995902	30		34	
27	45	9.136074	10.863926	9.140176	10.859824	10.004102	9.995898	15		33	
28	52	9.136303	10.863697	9.140409	10.859591	10.004106	9.995894	8		32	
29	15	9.136531	10.863469	9.140642	10.859358	10.004111	9.995889	45		31	
30	30	9.136760	10.863240	9.140875	10.859125	10.004115	9.995885	30		30	
31	45	9.136988	10.863012	9.141107	10.858893	10.004120	9.995880	15		29	
32	53	9.137216	10.862784	9.141340	10.858660	10.004124	9.995876	7		28	
33	15	9.137444	10.862556	9.141572	10.858428	10.004128	9.995872	45		27	
34	30	9.137672	10.862328	9.141805	10.858195	10.004133	9.995867	30		26	
35	45	9.137900	10.862100	9.142037	10.857963	10.004137	9.995863	15		25	
36	54	9.138127	10.861873	9.142269	10.857731	10.004141	9.995859	6		24	
37	15	9.138355	10.861645	9.142501	10.857499	10.004146	9.995854	45		23	
38	30	9.138582	10.861418	9.142733	10.857267	10.004150	9.995850	30		22	
39	45	9.138810	10.861190	9.142964	10.857036	10.004155	9.995845	15		21	
40	55	9.139037	10.860963	9.143196	10.856804	10.004159	9.995841	5		20	
41	15	9.139264	10.860736	9.143427	10.856573	10.004163	9.995837	45		19	
42	30	9.139491	10.860509	9.143659	10.856341	10.004168	9.995832	30		18	
43	45	9.139718	10.860282	9.143890	10.856110	10.004172	9.995828	15		17	
44	56	9.139944	10.860056	9.144121	10.855879	10.004177	9.995823	4		16	
45	15	9.140171	10.859829	9.144352	10.855648	10.004181	9.995819	45		15	
46	30	9.140397	10.859603	9.144583	10.855417	10.004185	9.995815	30		14	
47	45	9.140624	10.859376	9.144814	10.855186	10.004190	9.995810	15		13	
48	57	9.140850	10.859150	9.145044	10.854956	10.004194	9.995806	3		12	
49	15	9.141076	10.858924	9.145275	10.854725	10.004199	9.995801	45		11	
50	30	9.141302	10.858698	9.145505	10.854495	10.004203	9.995797	30		10	
51	45	9.141528	10.858472	9.145735	10.854265	10.004207	9.995793	15		9	
52	58	9.141754	10.858246	9.145965	10.854035	10.004212	9.995788	2		8	
53	15	9.141979	10.858021	9.146195	10.853805	10.004216	9.995784	45		7	
54	30	9.142205	10.857795	9.146425	10.853575	10.004221	9.995779	30		6	
55	45	9.142430	10.857570	9.146655	10.853345	10.004225	9.995775	15		5	
56	59	9.142655	10.857345	9.146885	10.853115	10.004230	9.995770	1		4	
57	15	9.142881	10.857119	9.147114	10.852886	10.004234	9.995766	45		3	
58	30	9.143106	10.856894	9.147344	10.852656	10.004238	9.995762	30		2	
59	45	9.143330	10.856670	9.147573	10.852427	10.004243	9.995757	15		1	
60	60	9.143555	10.856445	9.147802	10.852198	10.004247	9.995753	0		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
5 ^h 28 ^m .			LOG. SINES, &c.				82 deg.				

0 ^h 32 ^m .		LOG. SINES, &c. (t.)						8 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.143555	10.856445	9.147802	10.852198	10.004247	9.995753	60	60
1	15	9.143780	10.856220	9.148032	10.851968	10.004252	9.995748	45	59
2	30	9.144004	10.855996	9.148261	10.851739	10.004256	9.995744	30	58
3	45	9.144229	10.855771	9.148489	10.851511	10.004261	9.995739	15	57
4	1	9.144453	10.855547	9.148718	10.851282	10.004265	9.995735	59	56
5	15	9.144677	10.855323	9.148947	10.851053	10.004269	9.995731	45	55
6	30	9.144901	10.855099	9.149175	10.850825	10.004274	9.995726	30	54
7	45	9.145125	10.854875	9.149404	10.850596	10.004278	9.995722	15	53
8	2	9.145349	10.854651	9.149632	10.850368	10.004283	9.995717	58	52
9	15	9.145573	10.854427	9.149860	10.850140	10.004287	9.995713	45	51
10	30	9.145797	10.854203	9.150088	10.849912	10.004292	9.995708	30	50
11	45	9.146020	10.853980	9.150316	10.849684	10.004296	9.995704	15	49
12	3	9.146243	10.853757	9.150544	10.849456	10.004301	9.995699	57	48
13	15	9.146467	10.853533	9.150772	10.849228	10.004305	9.995695	45	47
14	30	9.146690	10.853310	9.150999	10.849001	10.004310	9.995690	30	46
15	45	9.146913	10.853087	9.151227	10.848773	10.004314	9.995686	15	45
16	4	9.147136	10.852864	9.151454	10.848546	10.004319	9.995681	56	44
17	15	9.147359	10.852641	9.151682	10.848318	10.004323	9.995677	45	43
18	30	9.147581	10.852419	9.151909	10.848091	10.004328	9.995672	30	42
19	45	9.147804	10.852196	9.152136	10.847864	10.004332	9.995668	15	41
20	5	9.148026	10.851974	9.152363	10.847637	10.004337	9.995663	55	40
21	15	9.148248	10.851752	9.152589	10.847411	10.004341	9.995659	45	39
22	30	9.148471	10.851529	9.152816	10.847184	10.004345	9.995655	30	38
23	45	9.148693	10.851307	9.153043	10.846957	10.004350	9.995650	15	37
24	6	9.148915	10.851085	9.153269	10.846731	10.004354	9.995646	54	36
25	15	9.149137	10.850863	9.153496	10.846504	10.004359	9.995641	45	35
26	30	9.149358	10.850642	9.153722	10.846278	10.004363	9.995637	30	34
27	45	9.149580	10.850420	9.153948	10.846052	10.004368	9.995632	15	33
28	7	9.149801	10.850199	9.154174	10.845826	10.004372	9.995628	53	32
29	15	9.150023	10.849977	9.154400	10.845600	10.004377	9.995623	45	31
30	30	9.150244	10.849756	9.154626	10.845374	10.004381	9.995619	30	30
31	45	9.150465	10.849535	9.154851	10.845149	10.004386	9.995614	15	29
32	8	9.150686	10.849314	9.155077	10.844923	10.004391	9.995609	52	28
33	15	9.150907	10.849093	9.155302	10.844698	10.004395	9.995605	45	27
34	30	9.151128	10.848872	9.155528	10.844472	10.004400	9.995600	30	26
35	45	9.151349	10.848651	9.155753	10.844247	10.004404	9.995596	15	25
36	9	9.151569	10.848431	9.155978	10.844022	10.004409	9.995591	51	24
37	15	9.151790	10.848210	9.156203	10.843797	10.004413	9.995587	45	23
38	30	9.152010	10.847990	9.156428	10.843572	10.004418	9.995582	30	22
39	45	9.152230	10.847770	9.156653	10.843347	10.004422	9.995578	15	21
40	10	9.152451	10.847549	9.156877	10.843123	10.004427	9.995573	50	20
41	15	9.152671	10.847329	9.157102	10.842898	10.004431	9.995569	45	19
42	30	9.152891	10.847109	9.157326	10.842674	10.004436	9.995564	30	18
43	45	9.153110	10.846890	9.157551	10.842449	10.004440	9.995560	15	17
44	11	9.153330	10.846670	9.157775	10.842225	10.004445	9.995555	49	16
45	15	9.153550	10.846450	9.157999	10.842001	10.004449	9.995551	45	15
46	30	9.153769	10.846231	9.158223	10.841777	10.004454	9.995546	30	14
47	45	9.153988	10.846012	9.158447	10.841553	10.004458	9.995542	15	13
48	12	9.154208	10.845792	9.158671	10.841329	10.004463	9.995537	48	12
49	15	9.154427	10.845573	9.158894	10.841106	10.004468	9.995532	45	11
50	30	9.154646	10.845354	9.159118	10.840882	10.004472	9.995528	30	10
51	45	9.154865	10.845135	9.159341	10.840659	10.004477	9.995523	15	9
52	13	9.155083	10.844917	9.159565	10.840435	10.004481	9.995519	47	8
53	15	9.155302	10.844693	9.159788	10.840212	10.004486	9.995514	45	7
54	30	9.155521	10.844479	9.160011	10.839989	10.004490	9.995510	30	6
55	45	9.155739	10.844261	9.160234	10.839766	10.004495	9.995505	15	5
56	14	9.155957	10.844043	9.160457	10.839543	10.004500	9.995500	46	4
57	15	9.156176	10.843824	9.160680	10.839320	10.004504	9.995496	45	3
58	30	9.156394	10.843606	9.160902	10.839098	10.004509	9.995491	30	2
59	45	9.156612	10.843388	9.161125	10.838875	10.004513	9.995487	15	1
60	15	9.156830	10.843170	9.161347	10.838653	10.004518	9.995482	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine	"	sec.
5 ^h 27 ^m .		LOG. SINES, &c.						81 deg.	

0 ^h 33 ^m .		LOG. SINES, &c. (t.)						8 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.156830	10.843170	9.161347	10.838653	10.004518	9.995482	45	60
1	15	9.157047	10.842953	9.161570	10.838430	10.004522	9.995478	45	59
2	30	9.157265	10.842735	9.161792	10.838208	10.004527	9.995473	30	58
3	45	9.157482	10.842518	9.162014	10.837986	10.004532	9.995468	15	57
4	16	9.157700	10.842300	9.162236	10.837764	10.004536	9.995464	44	56
5	15	9.157917	10.842083	9.162458	10.837542	10.004541	9.995459	45	55
6	30	9.158134	10.841866	9.162680	10.837320	10.004545	9.995455	30	54
7	45	9.158352	10.841648	9.162901	10.837099	10.004550	9.995450	15	53
8	17	9.158569	10.841431	9.163123	10.836877	10.004555	9.995445	43	52
9	15	9.158785	10.841215	9.163344	10.836656	10.004559	9.995441	45	51
10	30	9.159002	10.840998	9.163566	10.836434	10.004564	9.995436	30	50
11	45	9.159219	10.840781	9.163787	10.836213	10.004568	9.995432	15	49
12	18	9.159435	10.840565	9.164008	10.835992	10.004573	9.995427	42	48
13	15	9.159652	10.840348	9.164229	10.835771	10.004578	9.995422	45	47
14	30	9.159868	10.840132	9.164450	10.835550	10.004582	9.995418	30	46
15	45	9.160084	10.839916	9.164671	10.835329	10.004587	9.995413	15	45
16	19	9.160300	10.839700	9.164892	10.835108	10.004591	9.995409	41	44
17	15	9.160516	10.839484	9.165112	10.834888	10.004596	9.995404	45	43
18	30	9.160732	10.839268	9.165333	10.834667	10.004601	9.995399	30	42
19	45	9.160948	10.839052	9.165553	10.834447	10.004605	9.995395	15	41
20	20	9.161164	10.838836	9.165774	10.834226	10.004610	9.995390	40	40
21	15	9.161379	10.838621	9.165994	10.834006	10.004614	9.995386	45	39
22	30	9.161595	10.838405	9.166214	10.833786	10.004619	9.995381	30	38
23	45	9.161810	10.838190	9.166434	10.833566	10.004624	9.995376	15	37
24	21	9.162025	10.837975	9.166654	10.833346	10.004628	9.995372	39	36
25	15	9.162241	10.837759	9.166873	10.833127	10.004633	9.995367	45	35
26	30	9.162456	10.837544	9.167093	10.832907	10.004638	9.995362	30	34
27	45	9.162670	10.837330	9.167313	10.832687	10.004642	9.995358	15	33
28	22	9.162885	10.837115	9.167532	10.832468	10.004647	9.995353	38	32
29	15	9.163100	10.836900	9.167751	10.832249	10.004652	9.995348	45	31
30	30	9.163315	10.836685	9.167971	10.832029	10.004656	9.995344	30	30
31	45	9.163529	10.836471	9.168190	10.831810	10.004661	9.995339	15	29
32	23	9.163743	10.836257	9.168409	10.831591	10.004666	9.995334	37	28
33	15	9.163958	10.836042	9.168628	10.831372	10.004670	9.995330	45	27
34	30	9.164172	10.835828	9.168847	10.831153	10.004675	9.995325	30	26
35	45	9.164386	10.835614	9.169065	10.830935	10.004680	9.995320	15	25
36	24	9.164600	10.835400	9.169284	10.830716	10.004684	9.995316	36	24
37	15	9.164814	10.835186	9.169502	10.830498	10.004689	9.995311	45	23
38	30	9.165027	10.834973	9.169721	10.830279	10.004694	9.995306	30	22
39	45	9.165241	10.834759	9.169939	10.830061	10.004698	9.995302	15	21
40	25	9.165454	10.834546	9.170157	10.829843	10.004703	9.995297	35	20
41	15	9.165668	10.834332	9.170375	10.829625	10.004708	9.995292	45	19
42	30	9.165881	10.834119	9.170593	10.829407	10.004712	9.995288	30	18
43	45	9.166094	10.833906	9.170811	10.829189	10.004717	9.995283	15	17
44	26	9.166307	10.833693	9.171029	10.828971	10.004722	9.995278	34	16
45	15	9.166520	10.833480	9.171246	10.828754	10.004726	9.995274	45	15
46	30	9.166733	10.833267	9.171464	10.828536	10.004731	9.995269	30	14
47	45	9.166946	10.833054	9.171681	10.828319	10.004736	9.995264	15	13
48	27	9.167159	10.832841	9.171899	10.828101	10.004740	9.995260	33	12
49	15	9.167371	10.832629	9.172116	10.827884	10.004745	9.995255	45	11
50	30	9.167584	10.832416	9.172333	10.827667	10.004750	9.995250	30	10
51	45	9.167796	10.832204	9.172550	10.827450	10.004754	9.995246	15	9
52	28	9.168008	10.831992	9.172767	10.827233	10.004759	9.995241	32	8
53	15	9.168220	10.831780	9.172984	10.827016	10.004764	9.995236	45	7
54	30	9.168432	10.831568	9.173201	10.826799	10.004769	9.995231	30	6
55	45	9.168644	10.831356	9.173417	10.826583	10.004773	9.995227	15	5
56	29	9.168856	10.831144	9.173634	10.826366	10.004778	9.995222	31	4
57	15	9.169068	10.830932	9.173850	10.826150	10.004783	9.995217	45	3
58	30	9.169279	10.830721	9.174066	10.825934	10.004787	9.995213	30	2
59	45	9.169491	10.830509	9.174283	10.825717	10.004792	9.995208	15	1
60	30	9.169702	10.830298	9.174499	10.825501	10.004797	9.995203	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 26 ^m .		LOG. SINES, &c.						81 deg.	

0 ^h 34 ^m .		LOG. SINES, &c. (t.)						8 deg.	
sec.	"	sine.	cosecant.	tangent	cotangent.	secant.	cosine.	"	sec.
0	30	9.169702	10.830298	9.174499	10.825501	10.004797	9.995203	30	60
1	15	9.169913	10.830087	9.174715	10.825285	10.004802	9.995198	45	59
2	30	9.170124	10.829876	9.174931	10.825069	10.004806	9.995194	30	58
3	45	9.170336	10.829664	9.175146	10.824854	10.004811	9.995189	15	57
4	31	9.170546	10.829454	9.175362	10.824638	10.004816	9.995184	29	56
5	15	9.170757	10.829243	9.175578	10.824422	10.004820	9.995180	45	55
6	30	9.170968	10.829032	9.175793	10.824207	10.004825	9.995175	30	54
7	45	9.171179	10.828821	9.176009	10.823991	10.004830	9.995170	15	53
8	32	9.171389	10.828611	9.176224	10.823776	10.004835	9.995165	28	52
9	15	9.171600	10.828400	9.176439	10.823561	10.004839	9.995161	45	51
10	30	9.171819	10.828190	9.176654	10.823346	10.004844	9.995156	30	50
11	45	9.172020	10.827980	9.176869	10.823131	10.004849	9.995151	15	49
12	33	9.172230	10.827770	9.177084	10.822916	10.004854	9.995146	27	48
13	15	9.172440	10.827560	9.177299	10.822701	10.004858	9.995142	45	47
14	30	9.172650	10.827350	9.177513	10.822487	10.004863	9.995137	30	46
15	45	9.172860	10.827140	9.177728	10.822272	10.004868	9.995132	15	45
16	34	9.173070	10.826930	9.177942	10.822058	10.004873	9.995127	26	44
17	15	9.173279	10.826721	9.178157	10.821843	10.004877	9.995123	45	43
18	30	9.173489	10.826511	9.178371	10.821629	10.004882	9.995118	30	42
19	45	9.173698	10.826302	9.178585	10.821415	10.004887	9.995113	15	41
20	35	9.173908	10.826092	9.178799	10.821201	10.004892	9.995108	25	40
21	15	9.174117	10.825883	9.179013	10.820987	10.004896	9.995104	45	39
22	30	9.174326	10.825674	9.179227	10.820773	10.004901	9.995099	30	38
23	45	9.174535	10.825465	9.179441	10.820559	10.004906	9.995094	15	37
24	36	9.174744	10.825256	9.179655	10.820345	10.004911	9.995089	24	36
25	15	9.174953	10.825047	9.179868	10.820132	10.004916	9.995084	45	35
26	30	9.175161	10.824839	9.180082	10.819918	10.004920	9.995080	30	34
27	45	9.175370	10.824630	9.180295	10.819705	10.004925	9.995075	15	33
28	37	9.175578	10.824422	9.180508	10.819492	10.004930	9.995070	23	32
29	15	9.175787	10.824213	9.180721	10.819279	10.004935	9.995065	45	31
30	30	9.175995	10.824005	9.180934	10.819066	10.004939	9.995061	30	30
31	45	9.176203	10.823797	9.181147	10.818853	10.004944	9.995056	15	29
32	38	9.176411	10.823589	9.181360	10.818640	10.004949	9.995051	22	28
33	15	9.176619	10.823381	9.181573	10.818427	10.004954	9.995046	45	27
34	30	9.176827	10.823173	9.181786	10.818214	10.004959	9.995041	30	26
35	45	9.177035	10.822965	9.181998	10.818002	10.004963	9.995037	15	25
36	39	9.177242	10.822758	9.182211	10.817789	10.004968	9.995032	21	24
37	15	9.177450	10.822550	9.182423	10.817577	10.004973	9.995027	45	23
38	30	9.177657	10.822343	9.182635	10.817365	10.004978	9.995022	30	22
39	45	9.177865	10.822135	9.182847	10.817153	10.004983	9.995017	15	21
40	40	9.178072	10.821928	9.183059	10.816941	10.004987	9.995013	20	20
41	15	9.178279	10.821721	9.183271	10.816729	10.004992	9.995008	45	19
42	30	9.178486	10.821514	9.183483	10.816517	10.004997	9.995003	30	18
43	45	9.178693	10.821307	9.183695	10.816305	10.005002	9.994998	15	17
44	41	9.178900	10.821100	9.183907	10.816093	10.005007	9.994993	19	16
45	15	9.179107	10.820893	9.184118	10.815882	10.005012	9.994988	45	15
46	30	9.179313	10.820687	9.184330	10.815670	10.005016	9.994984	30	14
47	45	9.179520	10.820480	9.184541	10.815459	10.005021	9.994979	15	13
48	42	9.179726	10.820274	9.184752	10.815248	10.005026	9.994974	18	12
49	15	9.179933	10.820067	9.184964	10.815036	10.005031	9.994969	45	11
50	30	9.180139	10.819861	9.185175	10.814825	10.005036	9.994964	30	10
51	45	9.180345	10.819655	9.185386	10.814614	10.005041	9.994959	15	9
52	43	9.180551	10.819449	9.185597	10.814403	10.005045	9.994955	17	8
53	15	9.180757	10.819243	9.185807	10.814193	10.005050	9.994950	45	7
54	30	9.180963	10.819037	9.186018	10.813982	10.005055	9.994945	30	6
55	45	9.181169	10.818831	9.186229	10.813771	10.005060	9.994940	15	5
56	44	9.181374	10.818626	9.186439	10.813561	10.005065	9.994935	16	4
57	15	9.181580	10.818420	9.186649	10.813351	10.005070	9.994930	45	3
58	30	9.181785	10.818215	9.186860	10.813140	10.005075	9.994925	30	2
59	45	9.181991	10.818009	9.187070	10.812930	10.005079	9.994921	15	1
60	45	9.182196	10.817804	9.187280	10.812720	10.005084	9.994916	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 25 ^m .		LOG. SINES, &c.						81 deg.	

0 ^h 35 ^m .		LOG. SINES, &c. (t.)						8 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.182196	10.817804	9.187280	10.812720	10.005084	9.994916	15	60
1	15	9.182401	10.817599	9.187490	10.812510	10.005089	9.994911	45	59
2	30	9.182606	10.817394	9.187700	10.812300	10.005094	9.994906	30	58
3	45	9.182811	10.817189	9.187910	10.812090	10.005099	9.994901	15	57
4	46	9.183016	10.816984	9.188120	10.811880	10.005104	9.994896	14	56
5	15	9.183221	10.816779	9.188329	10.811671	10.005109	9.994891	45	55
6	30	9.183425	10.816575	9.188539	10.811461	10.005113	9.994887	30	54
7	45	9.183630	10.816370	9.188748	10.811252	10.005118	9.994882	15	53
8	47	9.183834	10.816166	9.188957	10.811043	10.005123	9.994877	13	52
9	15	9.184039	10.815961	9.189167	10.810833	10.005128	9.994872	45	51
10	30	9.184243	10.815757	9.189376	10.810624	10.005133	9.994867	30	50
11	45	9.184447	10.815553	9.189585	10.810415	10.005138	9.994862	15	49
12	48	9.184651	10.815349	9.189794	10.810206	10.005143	9.994857	12	48
13	15	9.184855	10.815145	9.190003	10.809997	10.005148	9.994852	45	47
14	30	9.185059	10.814941	9.190211	10.809799	10.005153	9.994847	30	46
15	45	9.185263	10.814737	9.190420	10.809580	10.005157	9.994843	15	45
16	49	9.185466	10.814534	9.190629	10.809371	10.005162	9.994838	11	44
17	15	9.185670	10.814330	9.190837	10.809163	10.005167	9.994833	45	43
18	30	9.185873	10.814127	9.191046	10.808954	10.005172	9.994828	30	42
19	45	9.186077	10.813923	9.191254	10.808746	10.005177	9.994823	15	41
20	50	9.186280	10.813720	9.191462	10.808538	10.005182	9.994818	10	40
21	15	9.186483	10.813517	9.191670	10.808330	10.005187	9.994813	45	39
22	30	9.186686	10.813314	9.191878	10.808122	10.005192	9.994808	30	38
23	45	9.186889	10.813111	9.192086	10.807914	10.005197	9.994803	15	37
24	51	9.187092	10.812908	9.192294	10.807706	10.005202	9.994798	9	36
25	15	9.187295	10.812705	9.192502	10.807498	10.005206	9.994794	45	35
26	30	9.187498	10.812502	9.192709	10.807291	10.005211	9.994789	30	34
27	45	9.187700	10.812300	9.192917	10.807083	10.005216	9.994784	15	33
28	52	9.187903	10.812097	9.193124	10.806876	10.005221	9.994779	8	32
29	15	9.188105	10.811895	9.193331	10.806669	10.005226	9.994774	45	31
30	30	9.188308	10.811692	9.193539	10.806461	10.005231	9.994769	30	30
31	45	9.188510	10.811490	9.193746	10.806254	10.005236	9.994764	15	29
32	53	9.188712	10.811288	9.193953	10.806047	10.005241	9.994759	7	28
33	15	9.188914	10.811086	9.194160	10.805840	10.005246	9.994754	45	27
34	30	9.189116	10.810884	9.194367	10.805633	10.005251	9.994749	30	26
35	45	9.189318	10.810682	9.194573	10.805427	10.005256	9.994744	15	25
36	54	9.189519	10.810481	9.194780	10.805220	10.005261	9.994739	6	24
37	15	9.189721	10.810279	9.194987	10.805013	10.005266	9.994734	45	23
38	30	9.189923	10.810077	9.195193	10.804807	10.005271	9.994729	30	22
39	45	9.190124	10.809876	9.195400	10.804600	10.005276	9.994724	15	21
40	55	9.190325	10.809675	9.195606	10.804394	10.005281	9.994719	5	20
41	15	9.190527	10.809473	9.195812	10.804188	10.005286	9.994714	45	19
42	30	9.190728	10.809272	9.196018	10.803982	10.005290	9.994710	30	18
43	45	9.190929	10.809071	9.196224	10.803776	10.005295	9.994705	15	17
44	56	9.191130	10.808870	9.196430	10.803570	10.005300	9.994700	4	16
45	15	9.191331	10.808669	9.196636	10.803364	10.005305	9.994695	45	15
46	30	9.191531	10.808469	9.196842	10.803158	10.005310	9.994690	30	14
47	45	9.191732	10.808268	9.197047	10.802953	10.005315	9.994685	15	13
48	57	9.191933	10.808067	9.197253	10.802747	10.005320	9.994680	3	12
49	15	9.192133	10.807867	9.197458	10.802542	10.005325	9.994675	45	11
50	30	9.192334	10.807666	9.197664	10.802336	10.005330	9.994670	30	10
51	45	9.192534	10.807466	9.197869	10.802131	10.005335	9.994665	15	9
52	58	9.192734	10.807266	9.198074	10.801926	10.005340	9.994660	2	8
53	15	9.192934	10.807066	9.198279	10.801721	10.005345	9.994655	45	7
54	30	9.193134	10.806866	9.198484	10.801516	10.005350	9.994650	30	6
55	45	9.193334	10.806666	9.198689	10.801311	10.005355	9.994645	15	5
56	59	9.193534	10.806466	9.198894	10.801106	10.005360	9.994640	1	4
57	15	9.193734	10.806266	9.199099	10.800901	10.005365	9.994635	45	3
58	30	9.193933	10.806067	9.199303	10.800697	10.005370	9.994630	30	2
59	45	9.194133	10.805867	9.199508	10.800492	10.005375	9.994625	15	1
60	60	9.194332	10.805668	9.199712	10.800288	10.005380	9.994620	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 24 ^m .		LOG. SINES, &c.						81 deg.	

0 ^h 36 ^m .			LOG. SINES, &c. (t.)				9 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	0	9.194332	10.85668	9.199712	10.800288	10.005380	9.994620	60	60	
1	15	9.194532	10.805468	9.199917	10.800083	10.005385	9.994615	45	59	
2	30	9.194731	10.805269	9.200121	10.799879	10.005390	9.994610	30	58	
3	45	9.194930	10.805070	9.200325	10.799675	10.005395	9.994605	15	57	
4	1	9.195129	10.804871	9.200529	10.799471	10.005400	9.994600	59	56	
5	15	9.195328	10.804672	9.200733	10.799267	10.005405	9.994595	45	55	
6	30	9.195527	10.804473	9.200937	10.799063	10.005410	9.994590	30	54	
7	45	9.195726	10.804274	9.201141	10.798859	10.005415	9.994585	15	53	
8	2	9.195925	10.804075	9.201345	10.798655	10.005420	9.994580	58	52	
9	15	9.196123	10.803877	9.201548	10.798452	10.005425	9.994575	45	51	
10	30	9.196322	10.803678	9.201752	10.798248	10.005430	9.994570	30	50	
11	45	9.196520	10.803480	9.201955	10.798045	10.005435	9.994565	15	49	
12	3	9.196719	10.803281	9.202159	10.797841	10.005440	9.994560	57	48	
13	15	9.196917	10.803083	9.202362	10.797638	10.005445	9.994555	45	47	
14	30	9.197115	10.802885	9.202565	10.797435	10.005450	9.994550	30	46	
15	45	9.197313	10.802687	9.202768	10.797232	10.005455	9.994545	15	45	
16	4	9.197511	10.802489	9.202971	10.797029	10.005460	9.994540	56	44	
17	15	9.197709	10.802291	9.203174	10.796826	10.005466	9.994535	45	43	
18	30	9.197907	10.802093	9.203377	10.796623	10.005471	9.994530	30	42	
19	45	9.198104	10.801896	9.203580	10.796420	10.005476	9.994524	15	41	
20	5	9.198302	10.801698	9.203782	10.796218	10.005481	9.994519	55	40	
21	15	9.198499	10.801501	9.203985	10.796015	10.005486	9.994514	45	39	
22	30	9.198697	10.801303	9.204187	10.795813	10.005491	9.994509	30	38	
23	45	9.198894	10.801106	9.204390	10.795610	10.005496	9.994504	15	37	
24	6	9.199091	10.800909	9.204592	10.795408	10.005501	9.994499	54	36	
25	15	9.199288	10.800712	9.204794	10.795206	10.005506	9.994494	45	35	
26	30	9.199485	10.800515	9.204996	10.795004	10.005511	9.994489	30	34	
27	45	9.199682	10.800318	9.205198	10.794802	10.005516	9.994484	15	33	
28	7	9.199879	10.800121	9.205400	10.794600	10.005521	9.994479	53	32	
29	15	9.200076	10.799924	9.205602	10.794398	10.005526	9.994474	45	31	
30	30	9.200273	10.799727	9.205804	10.794196	10.005531	9.994469	30	30	
31	45	9.200469	10.799531	9.206006	10.793994	10.005536	9.994464	15	29	
32	8	9.200666	10.799334	9.206207	10.793793	10.005541	9.994459	52	28	
33	15	9.200862	10.799138	9.206409	10.793591	10.005546	9.994454	45	27	
34	30	9.201059	10.798941	9.206610	10.793390	10.005552	9.994448	30	26	
35	45	9.201255	10.798745	9.206811	10.793189	10.005557	9.994443	15	25	
36	9	9.201451	10.798549	9.207013	10.792987	10.005562	9.994438	51	24	
37	15	9.201647	10.798353	9.207214	10.792786	10.005567	9.994433	45	23	
38	30	9.201843	10.798157	9.207415	10.792585	10.005572	9.994428	30	22	
39	45	9.202039	10.797961	9.207616	10.792384	10.005577	9.994423	15	21	
40	10	9.202234	10.797766	9.207816	10.792184	10.005582	9.994418	50	20	
41	15	9.202430	10.797570	9.208017	10.791983	10.005587	9.994413	45	19	
42	30	9.202626	10.797374	9.208218	10.791782	10.005592	9.994408	30	18	
43	45	9.202821	10.797179	9.208419	10.791581	10.005597	9.994403	15	17	
44	11	9.203017	10.796983	9.208619	10.791381	10.005603	9.994397	49	16	
45	15	9.203212	10.796788	9.208819	10.791181	10.005608	9.994392	45	15	
46	30	9.203407	10.796593	9.209020	10.790980	10.005613	9.994387	30	14	
47	45	9.203602	10.796398	9.209220	10.790780	10.005618	9.994382	15	13	
48	12	9.203797	10.796203	9.209420	10.790580	10.005623	9.994377	48	12	
49	15	9.203992	10.796008	9.209620	10.790380	10.005628	9.994372	45	11	
50	30	9.204187	10.795813	9.209820	10.790180	10.005633	9.994367	30	10	
51	45	9.204382	10.795618	9.210020	10.789980	10.005638	9.994362	15	9	
52	13	9.204577	10.795423	9.210220	10.789780	10.005643	9.994357	47	8	
53	15	9.204771	10.795229	9.210420	10.789580	10.005649	9.994351	45	7	
54	30	9.204966	10.795034	9.210619	10.789381	10.005654	9.994346	30	6	
55	45	9.205160	10.794840	9.210819	10.789181	10.005659	9.994341	15	5	
56	14	9.205354	10.794646	9.211018	10.788982	10.005664	9.994336	46	4	
57	15	9.205549	10.794451	9.211218	10.788782	10.005669	9.994331	45	3	
58	30	9.205743	10.794257	9.211417	10.788583	10.005674	9.994326	30	2	
59	45	9.205937	10.794063	9.211616	10.788384	10.005679	9.994321	15	1	
60	15	9.206131	10.793869	9.211815	10.788185	10.005684	9.994316	45	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
5 ^h 23 ^m			LOG. SINES, &c.				80 deg.			

0 ^h 37 ^m .		LOG. SINES, &c. (t)						9 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.206131	10.793389	9.211815	10.788185	10.005684	9.994316	45	60
1	15	9.206325	10.793675	9.212014	10.787986	10.005690	9.994310	45	59
2	30	9.206519	10.793481	9.212213	10.787787	10.005695	9.994305	30	58
3	45	9.206712	10.793288	9.212412	10.787588	10.005700	9.994300	15	57
4	16	9.206906	10.793094	9.212611	10.787389	10.005705	9.994295	44	56
5	15	9.207099	10.792901	9.212810	10.787190	10.005710	9.994290	45	55
6	30	9.207293	10.792707	9.213008	10.786992	10.005715	9.994285	30	54
7	45	9.207486	10.792514	9.213207	10.786793	10.005721	9.994279	15	53
8	17	9.207679	10.792321	9.213405	10.786595	10.005726	9.994274	43	52
9	15	9.207873	10.792127	9.213603	10.786397	10.005731	9.994269	45	51
10	30	9.208066	10.791934	9.213802	10.786198	10.005736	9.994264	30	50
11	45	9.208259	10.791741	9.214000	10.786000	10.005741	9.994259	15	49
12	18	9.208452	10.791548	9.214198	10.785802	10.005746	9.994254	42	48
13	15	9.208644	10.791356	9.214396	10.785604	10.005752	9.994248	45	47
14	30	9.208837	10.791163	9.214594	10.785406	10.005757	9.994243	30	46
15	45	9.209030	10.790970	9.214792	10.785208	10.005762	9.994238	15	45
16	19	9.209222	10.790778	9.214989	10.785011	10.005767	9.994233	41	44
17	15	9.209415	10.790585	9.215187	10.784813	10.005772	9.994228	45	43
18	30	9.209607	10.790393	9.215385	10.784615	10.005777	9.994223	30	42
19	45	9.209799	10.790201	9.215582	10.784418	10.005783	9.994217	15	41
20	20	9.209992	10.790008	9.215779	10.784221	10.005788	9.994212	40	40
21	15	9.210184	10.789816	9.215977	10.784023	10.005793	9.994207	45	39
22	30	9.210376	10.789624	9.216174	10.783826	10.005798	9.994202	30	38
23	45	9.210568	10.789432	9.216371	10.783629	10.005803	9.994197	15	37
24	21	9.210760	10.789240	9.216568	10.783432	10.005809	9.994191	39	36
25	15	9.210951	10.789049	9.216765	10.783235	10.005814	9.994186	45	35
26	30	9.211143	10.788857	9.216962	10.783038	10.005819	9.994181	30	34
27	45	9.211335	10.788665	9.217159	10.782841	10.005824	9.994176	15	33
28	22	9.211526	10.788474	9.217356	10.782644	10.005829	9.994171	38	32
29	15	9.211718	10.788282	9.217552	10.782448	10.005835	9.994165	45	31
30	30	9.211909	10.788091	9.217749	10.782251	10.005840	9.994160	30	30
31	45	9.212100	10.787900	9.217945	10.782055	10.005845	9.994155	15	29
32	23	9.212291	10.787709	9.218142	10.781858	10.005850	9.994150	37	28
33	15	9.212482	10.787518	9.218338	10.781662	10.005856	9.994144	45	27
34	30	9.212673	10.787327	9.218534	10.781466	10.005861	9.994139	30	26
35	45	9.212864	10.787136	9.218730	10.781270	10.005866	9.994134	15	25
36	24	9.213055	10.786945	9.218926	10.781074	10.005871	9.994129	36	24
37	15	9.213246	10.786754	9.219122	10.780878	10.005876	9.994124	45	23
38	30	9.213437	10.786563	9.219318	10.780682	10.005882	9.994118	30	22
39	45	9.213627	10.786373	9.219514	10.780486	10.005887	9.994113	15	21
40	25	9.213818	10.786182	9.219710	10.780290	10.005892	9.994108	35	20
41	15	9.214008	10.785992	9.219905	10.780095	10.005897	9.994103	45	19
42	30	9.214198	10.785802	9.220101	10.779899	10.005903	9.994097	30	18
43	45	9.214389	10.785611	9.220296	10.779704	10.005908	9.994092	15	17
44	26	9.214579	10.785421	9.220492	10.779508	10.005913	9.994087	34	16
45	15	9.214769	10.785231	9.220687	10.779313	10.005918	9.994082	45	15
46	30	9.214959	10.785041	9.220882	10.779118	10.005924	9.994076	30	14
47	45	9.215149	10.784851	9.221077	10.778923	10.005929	9.994071	15	13
48	27	9.215338	10.784662	9.221272	10.778728	10.005934	9.994066	33	12
49	15	9.215528	10.784472	9.221467	10.778533	10.005939	9.994061	45	11
50	30	9.215718	10.784282	9.221662	10.778338	10.005945	9.994055	30	10
51	45	9.215907	10.784093	9.221857	10.778143	10.005950	9.994050	15	9
52	28	9.216097	10.783903	9.222052	10.777948	10.005955	9.994045	32	8
53	15	9.216286	10.783714	9.222246	10.777754	10.005960	9.994040	45	7
54	30	9.216475	10.783525	9.222441	10.777559	10.005966	9.994034	30	6
55	45	9.216664	10.783336	9.222635	10.777365	10.005971	9.994029	15	5
56	29	9.216854	10.783146	9.222830	10.777170	10.005976	9.994024	31	4
57	15	9.217043	10.782957	9.223024	10.776976	10.005982	9.994018	45	3
58	30	9.217232	10.782768	9.223218	10.776782	10.005987	9.994013	30	2
59	45	9.217420	10.782580	9.223412	10.776588	10.005992	9.994008	15	1
60	30	9.217609	10.782391	9.223606	10.776394	10.005997	9.994003	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 22 ^m .		LOG. SINES, &c.						80 deg.	

0 ^h 38 ^m .		LOG. SINES, &c. (t.)						9 deg		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	30	9.217609	10.782391	9.223606	10.776394	10.005997	9.994003	30		60
1	15	9.217798	10.782202	9.223800	10.776200	10.006003	9.993997	45		59
2	30	9.217986	10.782014	9.223994	10.776006	10.006008	9.993992	30		58
3	45	9.218175	10.781825	9.224188	10.775812	10.006013	9.993987	15		57
4	31	9.218363	10.781637	9.224382	10.775618	10.006019	9.993981	29		56
5	15	9.218552	10.781448	9.224576	10.775424	10.006024	9.993976	45		55
6	30	9.218740	10.781260	9.224769	10.775231	10.006029	9.993971	30		54
7	45	9.218928	10.781072	9.224963	10.775037	10.006034	9.993966	15		53
8	32	9.219116	10.780884	9.225156	10.774844	10.006040	9.993960	28		52
9	15	9.219304	10.780696	9.225349	10.774651	10.006045	9.993955	45		51
10	30	9.219492	10.780508	9.225543	10.774457	10.006050	9.993950	30		50
11	45	9.219680	10.780320	9.225736	10.774264	10.006056	9.993944	15		49
12	33	9.219868	10.780132	9.225929	10.774071	10.006061	9.993939	27		48
13	15	9.220056	10.779944	9.226122	10.773878	10.006066	9.993934	45		47
14	30	9.220243	10.779757	9.226315	10.773685	10.006071	9.993928	30		46
15	45	9.220431	10.779569	9.226508	10.773492	10.006077	9.993923	15		45
16	34	9.220618	10.779382	9.226700	10.773300	10.006082	9.993918	26		44
17	15	9.220805	10.779195	9.226893	10.773107	10.006088	9.993912	45		43
18	30	9.220993	10.779007	9.227086	10.772914	10.006093	9.993907	30		42
19	45	9.221180	10.778820	9.227278	10.772722	10.006098	9.993902	15		41
20	35	9.221367	10.778633	9.227471	10.772529	10.006104	9.993896	25		40
21	15	9.221554	10.778446	9.227663	10.772337	10.006109	9.993891	45		39
22	30	9.221741	10.778259	9.227855	10.772145	10.006114	9.993886	30		38
23	45	9.221928	10.778072	9.228047	10.771953	10.006120	9.993880	15		37
24	36	9.222115	10.777885	9.228239	10.771761	10.006125	9.993875	24		36
25	15	9.222301	10.777699	9.228431	10.771569	10.006130	9.993870	45		35
26	30	9.222488	10.777512	9.228623	10.771377	10.006136	9.993864	30		34
27	45	9.222674	10.777326	9.228815	10.771185	10.006141	9.993859	15		33
28	37	9.222861	10.777139	9.229007	10.770993	10.006146	9.993854	23		32
29	15	9.223047	10.776953	9.229199	10.770801	10.006152	9.993849	45		31
30	30	9.223234	10.776766	9.229390	10.770610	10.006157	9.993843	30		30
31	45	9.223420	10.776580	9.229582	10.770418	10.006162	9.993838	15		29
32	38	9.223606	10.776394	9.229773	10.770227	10.006168	9.993832	22		28
33	15	9.223792	10.776208	9.229965	10.770035	10.006173	9.993827	45		27
34	30	9.223978	10.776022	9.230156	10.769844	10.006178	9.993822	30		26
35	45	9.224164	10.775836	9.230347	10.769653	10.006184	9.993816	15		25
36	39	9.224349	10.775651	9.230539	10.769461	10.006189	9.993811	21		24
37	15	9.224535	10.775465	9.230730	10.769270	10.006195	9.993805	45		23
38	30	9.224721	10.775279	9.230921	10.769079	10.006200	9.993800	30		22
39	45	9.224906	10.775094	9.231112	10.768888	10.006205	9.993795	15		21
40	40	9.225092	10.774908	9.231302	10.768698	10.006211	9.993789	20		20
41	15	9.225277	10.774723	9.231493	10.768507	10.006216	9.993784	45		19
42	30	9.225462	10.774538	9.231684	10.768316	10.006221	9.993779	30		18
43	45	9.225648	10.774352	9.231874	10.768126	10.006227	9.993773	15		17
44	41	9.225833	10.774167	9.232065	10.767935	10.006232	9.993768	19		16
45	15	9.226018	10.773982	9.232255	10.767745	10.006238	9.993762	45		15
46	30	9.226203	10.773797	9.232446	10.767554	10.006243	9.993757	30		14
47	45	9.226388	10.773612	9.232636	10.767364	10.006248	9.993752	15		13
48	42	9.226572	10.773428	9.232826	10.767174	10.006254	9.993746	18		12
49	15	9.226757	10.773243	9.233016	10.766984	10.006259	9.993741	45		11
50	30	9.226942	10.773058	9.233206	10.766794	10.006265	9.993735	30		10
51	45	9.227126	10.772874	9.233396	10.766604	10.006270	9.993730	15		9
52	43	9.227311	10.772689	9.233586	10.766414	10.006275	9.993725	17		8
53	15	9.227495	10.772505	9.233776	10.766224	10.006281	9.993719	45		7
54	30	9.227680	10.772320	9.233966	10.766034	10.006286	9.993714	30		6
55	45	9.227864	10.772136	9.234155	10.765845	10.006292	9.993708	15		5
56	44	9.228048	10.771952	9.234345	10.765655	10.006297	9.993703	16		4
57	15	9.228232	10.771768	9.234535	10.765465	10.006302	9.993698	45		3
58	30	9.228416	10.771584	9.234724	10.765276	10.006308	9.993692	30		2
59	45	9.228600	10.771400	9.234913	10.765087	10.006313	9.993687	15		1
60	45	9.228784	10.771216	9.235103	10.764897	10.006319	9.993681	15		0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	'	sec.
5 ^h 21 ^m .		LOG. SINES, &c.						80 deg.		

0 ^h 39 ^m .		LOG. SINES, &c. (t)						9 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.228784	10.771216	9.235103	10.764897	10.006319	9.993681	15	60
1	15	9.228968	10.771032	9.235292	10.764708	10.006324	9.993676	45	59
2	30	9.229151	10.770849	9.235481	10.764519	10.006330	9.993670	30	58
3	45	9.229335	10.770665	9.235670	10.764330	10.006335	9.993665	15	57
4	46	9.229518	10.770482	9.235859	10.764141	10.006340	9.993660	14	56
5	15	9.229702	10.770298	9.236048	10.763952	10.006346	9.993654	45	55
6	30	9.229885	10.770115	9.236237	10.763763	10.006351	9.993649	30	54
7	45	9.230069	10.769931	9.236425	10.763575	10.006357	9.993643	15	53
8	47	9.230252	10.769748	9.236614	10.763386	10.006362	9.993638	13	52
9	15	9.230435	10.769565	9.236802	10.763198	10.006368	9.993632	45	51
10	30	9.230618	10.769382	9.236991	10.763009	10.006373	9.993627	30	50
11	45	9.230801	10.769199	9.237179	10.762821	10.006379	9.993621	15	49
12	48	9.230984	10.769016	9.237368	10.762632	10.006384	9.993616	12	48
13	15	9.231167	10.768833	9.237556	10.762444	10.006389	9.993611	45	47
14	30	9.231349	10.768651	9.237744	10.762256	10.006395	9.993605	30	46
15	45	9.231532	10.768468	9.237932	10.762068	10.006400	9.993600	15	45
16	49	9.231714	10.768286	9.238120	10.761880	10.006406	9.993594	11	44
17	15	9.231897	10.768103	9.238308	10.761692	10.006411	9.993589	45	43
18	30	9.232079	10.767921	9.238496	10.761504	10.006417	9.993583	30	42
19	45	9.232262	10.767738	9.238684	10.761316	10.006422	9.993578	15	41
20	50	9.232444	10.767556	9.238872	10.761128	10.006428	9.993572	10	40
21	15	9.232626	10.767374	9.239059	10.760941	10.006433	9.993567	45	39
22	30	9.232808	10.767192	9.239247	10.760753	10.006439	9.993561	30	38
23	45	9.232990	10.767010	9.239434	10.760566	10.006444	9.993556	15	37
24	51	9.233172	10.766828	9.239622	10.760378	10.006450	9.993550	9	36
25	15	9.233354	10.766646	9.239809	10.760191	10.006455	9.993545	45	35
26	30	9.233536	10.766464	9.239996	10.760004	10.006461	9.993539	30	34
27	45	9.233718	10.766282	9.240184	10.759816	10.006466	9.993534	15	33
28	52	9.233899	10.766101	9.240371	10.759629	10.006472	9.993528	8	32
29	15	9.234081	10.765919	9.240558	10.759442	10.006477	9.993523	45	31
30	30	9.234262	10.765738	9.240745	10.759255	10.006483	9.993517	30	30
31	45	9.234444	10.765556	9.240932	10.759068	10.006488	9.993512	15	29
32	53	9.234625	10.765375	9.241118	10.758882	10.006494	9.993506	7	28
33	15	9.234806	10.765194	9.241305	10.758695	10.006499	9.993501	45	27
34	30	9.234987	10.765013	9.241492	10.758508	10.006505	9.993495	30	26
35	45	9.235168	10.764832	9.241678	10.758322	10.006510	9.993490	15	25
36	54	9.235349	10.764651	9.241865	10.758135	10.006516	9.993484	6	24
37	15	9.235530	10.764470	9.242051	10.757949	10.006521	9.993479	45	23
38	30	9.235711	10.764289	9.242238	10.757762	10.006527	9.993473	30	22
39	45	9.235892	10.764108	9.242424	10.757576	10.006532	9.993468	15	21
40	55	9.236073	10.763927	9.242610	10.757390	10.006538	9.993462	5	20
41	15	9.236253	10.763747	9.242796	10.757204	10.006543	9.993457	45	19
42	30	9.236434	10.763566	9.242982	10.757018	10.006549	9.993451	30	18
43	45	9.236614	10.763386	9.243168	10.756832	10.006554	9.993446	15	17
44	56	9.236795	10.763205	9.243354	10.756646	10.006560	9.993440	4	16
45	15	9.236975	10.763025	9.243540	10.756460	10.006565	9.993435	45	15
46	30	9.237155	10.762845	9.243726	10.756274	10.006571	9.993429	30	14
47	45	9.237335	10.762665	9.243912	10.756088	10.006576	9.993424	15	13
48	57	9.237515	10.762485	9.244097	10.755903	10.006582	9.993418	3	12
49	15	9.237695	10.762305	9.244283	10.755717	10.006587	9.993413	45	11
50	30	9.237875	10.762125	9.244468	10.755532	10.006593	9.993407	30	10
51	45	9.238055	10.761945	9.244654	10.755346	10.006599	9.993401	15	9
52	58	9.238235	10.761765	9.244839	10.755161	10.006604	9.993396	2	8
53	15	9.238415	10.761585	9.245024	10.754976	10.006610	9.993390	45	7
54	30	9.238594	10.761406	9.245209	10.754791	10.006615	9.993385	30	6
55	45	9.238774	10.761226	9.245394	10.754606	10.006621	9.993379	15	5
56	59	9.238953	10.761047	9.245579	10.754421	10.006626	9.993374	1	4
57	15	9.239132	10.760868	9.245764	10.754236	10.006632	9.993368	45	3
58	30	9.239312	10.760688	9.245949	10.754051	10.006637	9.993363	30	2
59	45	9.239491	10.760509	9.246134	10.753866	10.006643	9.993357	15	1
60	60	9.239670	10.760330	9.246319	10.753681	10.006649	9.993351	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 20 ^m .		LOG. SINES, &c.						80 deg.	

0 ^h 40 ^m .		LOG. SINES, &c. (t.)						10 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.239670	10.760330	9.246319	10.753681	10.006649	9.993351	60	60
1	15	9.239849	10.760151	9.246503	10.753497	10.006654	9.993346	45	59
2	30	9.240028	10.759972	9.246688	10.753312	10.006660	9.993340	30	58
3	45	9.240207	10.759793	9.246872	10.753128	10.006665	9.993335	15	57
4	1	9.240386	10.759614	9.247057	10.752943	10.006671	9.993329	59	56
5	15	9.240565	10.759435	9.247241	10.752750	10.006676	9.993324	45	55
6	30	9.240744	10.759256	9.247425	10.752575	10.006682	9.993318	30	54
7	45	9.240922	10.759078	9.247610	10.752390	10.006688	9.993312	15	53
8	2	9.241101	10.758899	9.247794	10.752206	10.006693	9.993307	58	52
9	15	9.241279	10.758721	9.247978	10.752022	10.006699	9.993301	45	51
10	30	9.241458	10.758542	9.248162	10.751838	10.006704	9.993296	30	50
11	45	9.241636	10.758364	9.248346	10.751654	10.006710	9.993290	15	49
12	3	9.241814	10.758186	9.248530	10.751470	10.006716	9.993284	57	48
13	15	9.241992	10.758008	9.248713	10.751287	10.006721	9.993279	45	47
14	30	9.242170	10.757830	9.248897	10.751103	10.006727	9.993273	30	46
15	45	9.242348	10.757652	9.249081	10.750919	10.006732	9.993268	15	45
16	4	9.242526	10.757474	9.249264	10.750736	10.006738	9.993262	56	44
17	15	9.242704	10.757296	9.249448	10.750552	10.006744	9.993256	45	43
18	30	9.242882	10.757118	9.249631	10.750369	10.006749	9.993251	30	42
19	45	9.243060	10.756940	9.249814	10.750186	10.006755	9.993245	15	41
20	5	9.243237	10.756763	9.249998	10.750002	10.006760	9.993240	55	40
21	15	9.243415	10.756585	9.250181	10.749819	10.006766	9.993234	45	39
22	30	9.243592	10.756408	9.250364	10.749636	10.006772	9.993228	30	38
23	45	9.243770	10.756230	9.250547	10.749453	10.006777	9.993223	15	37
24	6	9.243947	10.756053	9.250730	10.749270	10.006783	9.993217	54	36
25	15	9.244124	10.755876	9.250913	10.749087	10.006789	9.993211	45	35
26	30	9.244302	10.755698	9.251096	10.748904	10.006794	9.993206	30	34
27	45	9.244479	10.755521	9.251278	10.748722	10.006800	9.993200	15	33
28	7	9.244656	10.755344	9.251461	10.748539	10.006805	9.993195	53	32
29	15	9.244833	10.755167	9.251644	10.748356	10.006811	9.993189	45	31
30	30	9.245010	10.754990	9.251826	10.748174	10.006817	9.993183	30	30
31	45	9.245186	10.754814	9.252009	10.747991	10.006822	9.993178	15	29
32	8	9.245363	10.754637	9.252191	10.747809	10.006828	9.993172	52	28
33	15	9.245540	10.754460	9.252373	10.747627	10.006834	9.993166	45	27
34	30	9.245716	10.754284	9.252556	10.747444	10.006839	9.993161	30	26
35	45	9.245893	10.754107	9.252738	10.747262	10.006845	9.993155	15	25
36	9	9.246069	10.753931	9.252920	10.747080	10.006851	9.993149	51	24
37	15	9.246246	10.753754	9.253102	10.746898	10.006856	9.993144	45	23
38	30	9.246422	10.753578	9.253284	10.746716	10.006862	9.993138	30	22
39	45	9.246598	10.753402	9.253466	10.746534	10.006868	9.993132	15	21
40	10	9.246775	10.753225	9.253648	10.746352	10.006873	9.993127	50	20
41	15	9.246951	10.753049	9.253829	10.746171	10.006879	9.993121	45	19
42	30	9.247127	10.752873	9.254011	10.745989	10.006885	9.993115	30	18
43	45	9.247303	10.752697	9.254193	10.745807	10.006890	9.993110	15	17
44	11	9.247478	10.752522	9.254374	10.745626	10.006896	9.993104	49	16
45	15	9.247654	10.752346	9.254556	10.745444	10.006902	9.993098	45	15
46	30	9.247830	10.752170	9.254737	10.745263	10.006907	9.993093	30	14
47	45	9.248006	10.751994	9.254918	10.745082	10.006913	9.993087	15	13
48	12	9.248181	10.751819	9.255100	10.744900	10.006919	9.993081	48	12
49	15	9.248357	10.751643	9.255281	10.744719	10.006924	9.993076	45	11
50	30	9.248532	10.751468	9.255462	10.744538	10.006930	9.993070	30	10
51	45	9.248707	10.751293	9.255643	10.744357	10.006936	9.993064	15	9
52	13	9.248883	10.751117	9.255824	10.744176	10.006941	9.993059	47	8
53	15	9.249058	10.750942	9.256005	10.743995	10.006947	9.993053	45	7
54	30	9.249233	10.750767	9.256186	10.743814	10.006953	9.993047	30	6
55	45	9.249408	10.750592	9.256366	10.743634	10.006958	9.993042	15	5
56	14	9.249583	10.750417	9.256547	10.743453	10.006964	9.993036	46	4
57	15	9.249758	10.750242	9.256728	10.743272	10.006970	9.993030	45	3
58	30	9.249933	10.750067	9.256908	10.743092	10.006976	9.993024	30	2
59	45	9.250107	10.749893	9.257089	10.742911	10.006981	9.993019	15	1
60	15	9.250282	10.749718	9.257269	10.742731	10.006987	9.993013	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine	"	sec.
5 ^h 19 ^m .		LOG. SINES, &c.						79 deg.	

0 ^h 41 ^m .		LOG. SINES, &c. (t)						10 deg.		
sec.	"	sine.	cosecant	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	15	9.250282	10.749718	9.257269	10.742731	10.006987	9.993013	45		60
1	15	9.250457	10.749543	9.257449	10.742551	10.006993	9.993007	45		59
2	30	9.250631	10.749369	9.257630	10.742370	10.006998	9.993002	30		58
3	45	9.250806	10.749194	9.257810	10.742190	10.007004	9.992996	15		57
4	16	9.250980	10.749020	9.257990	10.742010	10.007010	9.992990		44	56
5	15	9.251155	10.748845	9.258170	10.741830	10.007016	9.992984	45		55
6	30	9.251329	10.748671	9.258350	10.741650	10.007021	9.992979	30		54
7	45	9.251503	10.748497	9.258530	10.741470	10.007027	9.992973	15		53
8	17	9.251677	10.748323	9.258710	10.741290	10.007033	9.992967		43	52
9	15	9.251851	10.748149	9.258890	10.741110	10.007038	9.992962	45		51
10	30	9.252025	10.747975	9.259069	10.740931	10.007044	9.992956	30		50
11	45	9.252199	10.747801	9.259249	10.740751	10.007050	9.992950	15		49
12	18	9.252373	10.747627	9.259428	10.740572	10.007056	9.992944		42	48
13	15	9.252547	10.747453	9.259608	10.740392	10.007061	9.992939	45		47
14	30	9.252720	10.747280	9.259787	10.740213	10.007067	9.992933	30		46
15	45	9.252894	10.747106	9.259967	10.740033	10.007073	9.992927	15		45
16	19	9.253067	10.746933	9.260146	10.739854	10.007079	9.992921		41	44
17	15	9.253241	10.746759	9.260325	10.739675	10.007084	9.992916	45		43
18	30	9.253414	10.746586	9.260504	10.739496	10.007090	9.992910	30		42
19	45	9.253588	10.746412	9.260683	10.739317	10.007096	9.992904	15		41
20	20	9.253761	10.746239	9.260862	10.739138	10.007102	9.992898		40	40
21	15	9.253934	10.746066	9.261041	10.738959	10.007107	9.992893	45		39
22	30	9.254107	10.745893	9.261220	10.738780	10.007113	9.992887	30		38
23	45	9.254280	10.745720	9.261399	10.738601	10.007119	9.992881	15		37
24	21	9.254453	10.745547	9.261578	10.738422	10.007125	9.992875		39	36
25	15	9.254626	10.745374	9.261757	10.738243	10.007131	9.992869	45		35
26	30	9.254799	10.745201	9.261935	10.738065	10.007136	9.992864	30		34
27	45	9.254972	10.745028	9.262114	10.737886	10.007142	9.992858	15		33
28	22	9.255144	10.744856	9.262292	10.737708	10.007148	9.992852		38	32
29	15	9.255317	10.744683	9.262470	10.737530	10.007154	9.992846	45		31
30	30	9.255489	10.744511	9.262649	10.737351	10.007159	9.992841	30		30
31	45	9.255662	10.744338	9.262827	10.737173	10.007165	9.992835	15		29
32	23	9.255834	10.744166	9.263005	10.736995	10.007171	9.992829		37	28
33	15	9.256007	10.743993	9.263183	10.736817	10.007177	9.992823	45		27
34	30	9.256179	10.743821	9.263361	10.736639	10.007183	9.992817	30		26
35	45	9.256351	10.743649	9.263539	10.736461	10.007188	9.992812	15		25
36	24	9.256523	10.743477	9.263717	10.736283	10.007194	9.992806		36	24
37	15	9.256695	10.743305	9.263895	10.736105	10.007200	9.992800	45		23
38	30	9.256867	10.743133	9.264073	10.735927	10.007206	9.992794	30		22
39	45	9.257039	10.742961	9.264251	10.735749	10.007212	9.992788	15		21
40	25	9.257211	10.742789	9.264428	10.735572	10.007217	9.992783		35	20
41	15	9.257383	10.742617	9.264606	10.735394	10.007223	9.992777	45		19
42	30	9.257554	10.742446	9.264783	10.735217	10.007229	9.992771	30		18
43	45	9.257726	10.742274	9.264961	10.735039	10.007235	9.992765	15		17
44	26	9.257898	10.742102	9.265138	10.734862	10.007241	9.992759		34	16
45	15	9.258069	10.741931	9.265315	10.734685	10.007246	9.992754	45		15
46	30	9.258241	10.741759	9.265493	10.734507	10.007252	9.992748	30		14
47	45	9.258412	10.741588	9.265670	10.734330	10.007258	9.992742	15		13
48	27	9.258583	10.741417	9.265847	10.734153	10.007264	9.992736		33	12
49	15	9.258754	10.741246	9.266024	10.733976	10.007270	9.992730	45		11
50	30	9.258925	10.741075	9.266201	10.733799	10.007276	9.992724	30		10
51	45	9.259097	10.740903	9.266378	10.733622	10.007281	9.992719	15		9
52	28	9.259268	10.740732	9.266555	10.733445	10.007287	9.992713		32	8
53	15	9.259438	10.740562	9.266731	10.733269	10.007293	9.992707	45		7
54	30	9.259609	10.740391	9.266908	10.733092	10.007299	9.992701	30		6
55	45	9.259780	10.740220	9.267085	10.732915	10.007305	9.992695	15		5
56	29	9.259951	10.740049	9.267261	10.732739	10.007311	9.992689		31	4
57	15	9.260121	10.739879	9.267438	10.732562	10.007316	9.992684	45		3
58	30	9.260292	10.739708	9.267614	10.732386	10.007322	9.992678	30		2
59	45	9.260463	10.739537	9.267791	10.732209	10.007328	9.992672	15		1
60	30	9.260633	10.739367	9.267967	10.732033	10.007334	9.992666		30	0
sec.	"	cscine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
5 ^h 18 ^m .		LOG. SINES, &c.						79 deg.		

0 ^h 42 ^m .		LOG. SINES, &c. (t.)						10 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.260633	10.739367	9.267967	10.732033	10.007334	9.992666	30	60
1	15	9.260803	10.739197	9.268143	10.731857	10.007340	9.992660	45	59
2	30	9.260974	10.739026	9.268319	10.731681	10.007346	9.992654	30	58
3	45	9.261144	10.738856	9.268495	10.731505	10.007351	9.992649	15	57
4	31	9.261314	10.738686	9.268671	10.731329	10.007357	9.992643	29	56
5	15	9.261484	10.738516	9.268847	10.731153	10.007363	9.992637	45	55
6	30	9.261654	10.738346	9.269023	10.730977	10.007369	9.992631	30	54
7	45	9.261824	10.738176	9.269199	10.730801	10.007375	9.992625	15	53
8	32	9.261994	10.738006	9.269375	10.730625	10.007381	9.992619	28	52
9	15	9.262164	10.737836	9.269551	10.730449	10.007387	9.992613	45	51
10	30	9.262334	10.737666	9.269726	10.730274	10.007393	9.992607	30	50
11	45	9.262503	10.737497	9.269902	10.730098	10.007398	9.992602	15	49
12	33	9.262673	10.737327	9.270077	10.729923	10.007404	9.992596	27	48
13	15	9.262842	10.737158	9.270253	10.729747	10.007410	9.992590	45	47
14	30	9.263012	10.736988	9.270428	10.729572	10.007416	9.992584	30	46
15	45	9.263181	10.736819	9.270603	10.729397	10.007422	9.992578	15	45
16	34	9.263351	10.736649	9.270779	10.729221	10.007428	9.992572	26	44
17	15	9.263520	10.736480	9.270954	10.729046	10.007434	9.992566	45	43
18	30	9.263689	10.736311	9.271129	10.728871	10.007440	9.992560	30	42
19	45	9.263858	10.736142	9.271304	10.728696	10.007446	9.992554	15	41
20	35	9.264027	10.735973	9.271479	10.728521	10.007451	9.992549	25	40
21	15	9.264196	10.735804	9.271654	10.728346	10.007457	9.992543	45	39
22	30	9.264365	10.735635	9.271829	10.728171	10.007463	9.992537	30	38
23	45	9.264534	10.735466	9.272003	10.727997	10.007469	9.992531	15	37
24	36	9.264703	10.735297	9.272178	10.727822	10.007475	9.992525	24	36
25	15	9.264872	10.735128	9.272353	10.727647	10.007481	9.992519	45	35
26	30	9.265040	10.734960	9.272527	10.727473	10.007487	9.992513	30	34
27	45	9.265209	10.734791	9.272702	10.727298	10.007493	9.992507	15	33
28	37	9.265377	10.734623	9.272876	10.727124	10.007499	9.992501	23	32
29	15	9.265546	10.734454	9.273051	10.726949	10.007505	9.992495	45	31
30	30	9.265714	10.734286	9.273225	10.726775	10.007511	9.992489	30	30
31	45	9.265883	10.734117	9.273399	10.726601	10.007517	9.992483	15	29
32	38	9.266051	10.733949	9.273573	10.726427	10.007522	9.992478	22	28
33	15	9.266219	10.733781	9.273747	10.726253	10.007528	9.992472	45	27
34	30	9.266387	10.733613	9.273921	10.726079	10.007534	9.992466	30	26
35	45	9.266555	10.733445	9.274095	10.725905	10.007540	9.992460	15	25
36	39	9.266723	10.733277	9.274269	10.725731	10.007546	9.992454	21	24
37	15	9.266891	10.733109	9.274443	10.725557	10.007552	9.992448	45	23
38	30	9.267059	10.732941	9.274617	10.725383	10.007558	9.992442	30	22
39	45	9.267227	10.732773	9.274791	10.725209	10.007564	9.992436	15	21
40	40	9.267394	10.732606	9.274964	10.725036	10.007570	9.992430	20	20
41	15	9.267562	10.732438	9.275138	10.724862	10.007576	9.992424	45	19
42	30	9.267730	10.732270	9.275312	10.724688	10.007582	9.992418	30	18
43	45	9.267897	10.732103	9.275485	10.724515	10.007588	9.992412	15	17
44	41	9.268065	10.731935	9.275658	10.724342	10.007594	9.992406	19	16
45	15	9.268232	10.731768	9.275832	10.724168	10.007600	9.992400	45	15
46	30	9.268399	10.731601	9.276005	10.723995	10.007606	9.992394	30	14
47	45	9.268567	10.731433	9.276178	10.723822	10.007612	9.992388	15	13
48	42	9.268734	10.731266	9.276351	10.723649	10.007618	9.992382	18	12
49	15	9.268901	10.731099	9.276524	10.723476	10.007624	9.992376	45	11
50	30	9.269068	10.730932	9.276697	10.723303	10.007630	9.992370	30	10
51	45	9.269235	10.730765	9.276870	10.723130	10.007636	9.992364	15	9
52	43	9.269402	10.730598	9.277043	10.722957	10.007642	9.992358	17	8
53	15	9.269569	10.730431	9.277216	10.722784	10.007648	9.992352	45	7
54	30	9.269735	10.730265	9.277389	10.722611	10.007653	9.992347	30	6
55	45	9.269902	10.730098	9.277562	10.722438	10.007659	9.992341	15	5
56	44	9.270069	10.729931	9.277734	10.722266	10.007665	9.992335	16	4
57	15	9.270235	10.729765	9.277907	10.722093	10.007671	9.992329	45	3
58	30	9.270402	10.729598	9.278079	10.721921	10.007677	9.992323	30	2
59	45	9.270568	10.729432	9.278252	10.721748	10.007683	9.992317	15	1
60	45	9.270735	10.729265	9.278424	10.721576	10.007689	9.992311	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 17 ^m .		LOG. SINES, &c.						79 deg.	

0 ^h 43 ^m .		LOG. SINES, &c. (t.)						10 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.270735	10.729265	9.278424	10.721576	10.007689	9.992311	15	60
1	15	9.270901	10.729099	9.278596	10.721404	10.007695	9.992305	45	59
2	30	9.271067	10.728933	9.278769	10.721231	10.007701	9.992299	30	58
3	45	9.271234	10.728766	9.278941	10.721059	10.007707	9.992293	15	57
4	46	9.271400	10.728600	9.279113	10.720887	10.007713	9.992287	14	56
5	15	9.271566	10.728434	9.279285	10.720715	10.007719	9.992281	45	55
6	30	9.271732	10.728268	9.279457	10.720543	10.007725	9.992275	30	54
7	45	9.271898	10.728102	9.279629	10.720371	10.007731	9.992269	15	53
8	47	9.272063	10.727937	9.279801	10.720199	10.007737	9.992263	13	52
9	15	9.272229	10.727771	9.279973	10.720027	10.007743	9.992257	45	51
10	30	9.272395	10.727605	9.280144	10.719856	10.007749	9.992251	30	50
11	45	9.272561	10.727439	9.280316	10.719684	10.007756	9.992244	15	49
12	48	9.272726	10.727274	9.280488	10.719512	10.007762	9.992238	12	48
13	15	9.272892	10.727108	9.280659	10.719341	10.007768	9.992232	45	47
14	30	9.273057	10.726943	9.280831	10.719169	10.007774	9.992226	30	46
15	45	9.273223	10.726777	9.281002	10.718998	10.007780	9.992220	15	45
16	49	9.273388	10.726612	9.281174	10.718826	10.007786	9.992214	11	44
17	15	9.273553	10.726447	9.281345	10.718655	10.007792	9.992208	45	43
18	30	9.273718	10.726282	9.281516	10.718484	10.007798	9.992202	30	42
19	45	9.273884	10.726116	9.281687	10.718313	10.007804	9.992196	15	41
20	50	9.274049	10.725951	9.281858	10.718142	10.007810	9.992190	10	40
21	15	9.274214	10.725786	9.282029	10.717971	10.007816	9.992184	45	39
22	30	9.274379	10.725621	9.282200	10.717800	10.007822	9.992178	30	38
23	45	9.274543	10.725457	9.282371	10.717629	10.007828	9.992172	15	37
24	51	9.274708	10.725292	9.282542	10.717458	10.007834	9.992166	9	36
25	15	9.274873	10.725127	9.282713	10.717287	10.007840	9.992160	45	35
26	30	9.275038	10.724962	9.282884	10.717116	10.007846	9.992154	30	34
27	45	9.275202	10.724798	9.283054	10.716946	10.007852	9.992148	15	33
28	52	9.275367	10.724633	9.283225	10.716775	10.007858	9.992142	8	32
29	15	9.275531	10.724469	9.283396	10.716604	10.007864	9.992136	45	31
30	30	9.275696	10.724304	9.283566	10.716434	10.007870	9.992130	30	30
31	45	9.275860	10.724140	9.283737	10.716263	10.007876	9.992124	15	29
32	53	9.276024	10.723976	9.283907	10.716093	10.007883	9.992117	7	28
33	15	9.276189	10.723811	9.284077	10.715923	10.007889	9.992111	45	27
34	30	9.276353	10.723647	9.284247	10.715753	10.007895	9.992105	30	26
35	45	9.276517	10.723483	9.284418	10.715582	10.007901	9.992099	15	25
36	54	9.276681	10.723319	9.284588	10.715412	10.007907	9.992093	6	24
37	15	9.276845	10.723155	9.284758	10.715242	10.007913	9.992087	45	23
38	30	9.277009	10.722991	9.284928	10.715072	10.007919	9.992081	30	22
39	45	9.277173	10.722827	9.285098	10.714902	10.007925	9.992075	15	21
40	55	9.277337	10.722663	9.285268	10.714732	10.007931	9.992069	5	20
41	15	9.277500	10.722500	9.285437	10.714563	10.007937	9.992063	45	19
42	30	9.277664	10.722336	9.285607	10.714393	10.007943	9.992057	30	18
43	45	9.277827	10.722173	9.285777	10.714223	10.007949	9.992051	15	17
44	56	9.277991	10.722009	9.285947	10.714053	10.007956	9.992044	4	16
45	15	9.278154	10.721846	9.286116	10.713884	10.007962	9.992038	45	15
46	30	9.278318	10.721682	9.286286	10.713714	10.007968	9.992032	30	14
47	45	9.278481	10.721519	9.286455	10.713545	10.007974	9.992026	15	13
48	57	9.278644	10.721356	9.286624	10.713376	10.007980	9.992020	3	12
49	15	9.278808	10.721192	9.286794	10.713206	10.007986	9.992014	45	11
50	30	9.278971	10.721029	9.286963	10.713037	10.007992	9.992008	30	10
51	45	9.279134	10.720866	9.287132	10.712868	10.007998	9.992002	15	9
52	58	9.279297	10.720703	9.287301	10.712699	10.008004	9.991996	2	8
53	15	9.279460	10.720540	9.287470	10.712530	10.008011	9.991989	45	7
54	30	9.279623	10.720377	9.287639	10.712361	10.008017	9.991983	30	6
55	45	9.279786	10.720214	9.287808	10.712192	10.008023	9.991977	15	5
56	59	9.279948	10.720052	9.287977	10.712023	10.008029	9.991971	1	4
57	15	9.280111	10.719889	9.288146	10.711854	10.008035	9.991965	45	3
58	30	9.280274	10.719726	9.288315	10.711685	10.008041	9.991959	30	2
59	45	9.280436	10.719564	9.288484	10.711516	10.008047	9.991953	15	1
60	60	9.280599	10.719401	9.288652	10.711348	10.008053	9.991947	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 16 ^m .		LOG. SINES, &c.						79 deg.	

0 ^h 44 ^m .		LOG. SINES, &c. (t.)						11 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.280599	10.719401	9.288652	10.711348	10.008053	9.991947	60	60
1	15	9.280761	10.719239	9.288821	10.711179	10.008060	9.991940	45	59
2	30	9.280924	10.719076	9.288989	10.711011	10.008066	9.991934	30	58
3	45	9.281086	10.718914	9.289158	10.710842	10.008072	9.991928	15	57
4	1	9.281248	10.718752	9.289326	10.710674	10.008078	9.991922	59	56
5	15	9.281410	10.718590	9.289495	10.710505	10.008084	9.991916	45	55
6	30	9.281573	10.718427	9.289663	10.710337	10.008090	9.991910	30	54
7	45	9.281735	10.718265	9.289831	10.710169	10.008097	9.991903	15	53
8	2	9.281897	10.718103	9.289999	10.710001	10.008103	9.991897	58	52
9	15	9.282059	10.717941	9.290167	10.709833	10.008109	9.991891	45	51
10	30	9.282220	10.717780	9.290335	10.709665	10.008115	9.991885	30	50
11	45	9.282382	10.717618	9.290503	10.709497	10.008121	9.991879	15	49
12	3	9.282544	10.717456	9.290671	10.709329	10.008127	9.991873	57	48
13	15	9.282706	10.717294	9.290839	10.709161	10.008133	9.991867	45	47
14	30	9.282867	10.717133	9.291007	10.708993	10.008140	9.991860	30	46
15	45	9.283029	10.716971	9.291175	10.708825	10.008146	9.991854	15	45
16	4	9.283190	10.716810	9.291342	10.708658	10.008152	9.991848	56	44
17	15	9.283352	10.716648	9.291510	10.708490	10.008158	9.991842	45	43
18	30	9.283513	10.716487	9.291678	10.708322	10.008164	9.991836	30	42
19	45	9.283675	10.716325	9.291845	10.708155	10.008171	9.991829	15	41
20	5	9.283836	10.716164	9.292013	10.707987	10.008177	9.991823	55	40
21	15	9.283997	10.716003	9.292180	10.707820	10.008183	9.991817	45	39
22	30	9.284158	10.715842	9.292347	10.707653	10.008189	9.991811	30	38
23	45	9.284319	10.715681	9.292514	10.707486	10.008195	9.991805	15	37
24	6	9.284480	10.715520	9.292682	10.707318	10.008201	9.991799	54	36
25	15	9.284641	10.715359	9.292849	10.707151	10.008208	9.991792	45	35
26	30	9.284802	10.715198	9.293016	10.706984	10.008214	9.991786	30	34
27	45	9.284963	10.715037	9.293183	10.706817	10.008220	9.991780	15	33
28	7	9.285124	10.714876	9.293350	10.706650	10.008226	9.991774	53	32
29	15	9.285284	10.714716	9.293517	10.706483	10.008233	9.991767	45	31
30	30	9.285445	10.714555	9.293684	10.706316	10.008239	9.991761	30	30
31	45	9.285606	10.714394	9.293850	10.706150	10.008245	9.991755	15	29
32	8	9.285766	10.714234	9.294017	10.705983	10.008251	9.991749	52	28
33	15	9.285927	10.714073	9.294184	10.705816	10.008257	9.991743	45	27
34	30	9.286087	10.713913	9.294350	10.705650	10.008264	9.991736	30	26
35	45	9.286247	10.713753	9.294517	10.705483	10.008270	9.991730	15	25
36	9	9.286408	10.713592	9.294684	10.705316	10.008276	9.991724	51	24
37	15	9.286568	10.713432	9.294850	10.705150	10.008282	9.991718	45	23
38	30	9.286728	10.713272	9.295016	10.704984	10.008288	9.991712	30	22
39	45	9.286888	10.713112	9.295183	10.704817	10.008295	9.991705	15	21
40	10	9.287048	10.712952	9.295349	10.704651	10.008301	9.991699	50	20
41	15	9.287208	10.712792	9.295515	10.704485	10.008307	9.991693	45	19
42	30	9.287368	10.712632	9.295681	10.704319	10.008313	9.991687	30	18
43	45	9.287528	10.712472	9.295847	10.704153	10.008320	9.991680	15	17
44	11	9.287687	10.712313	9.296013	10.703987	10.008326	9.991674	49	16
45	15	9.287847	10.712153	9.296179	10.703821	10.008332	9.991668	45	15
46	30	9.288007	10.711993	9.296345	10.703655	10.008338	9.991662	30	14
47	45	9.288166	10.711834	9.296511	10.703489	10.008345	9.991655	15	13
48	12	9.288326	10.711674	9.296677	10.703323	10.008351	9.991649	48	12
49	15	9.288485	10.711515	9.296843	10.703157	10.008357	9.991643	45	11
50	30	9.288645	10.711355	9.297008	10.702992	10.008363	9.991637	30	10
51	45	9.288804	10.711196	9.297174	10.702826	10.008370	9.991630	15	9
52	13	9.288964	10.711036	9.297339	10.702661	10.008376	9.991624	47	8
53	15	9.289123	10.710877	9.297505	10.702495	10.008382	9.991618	45	7
54	30	9.289282	10.710718	9.297670	10.702330	10.008388	9.991612	30	6
55	45	9.289441	10.710559	9.297836	10.702164	10.008395	9.991605	15	5
56	14	9.289600	10.710400	9.298001	10.701999	10.008401	9.991599	46	4
57	15	9.289759	10.710241	9.298166	10.701834	10.008407	9.991593	45	3
58	30	9.289918	10.710082	9.298332	10.701668	10.008414	9.991586	30	2
59	45	9.290077	10.709923	9.298497	10.701503	10.008420	9.991580	15	1
60	15	9.290236	10.709764	9.298662	10.701338	10.008426	9.991574	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 15 ^m .		LOG. SINES, &c.						78 deg.	

0 ^h 45 ^m .			LOG. SINES, &c. (t.)				11 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.290236	10.709764	9.298662	10.701338	10.008426	9.991574	45	60
1	15	9.290394	10.709606	9.298827	10.701173	10.008432	9.991568	45	59
2	30	9.290553	10.709447	9.298992	10.701008	10.008439	9.991561	30	58
3	45	9.290712	10.709288	9.299157	10.700843	10.008445	9.991555	15	57
4	16	9.290870	10.709130	9.299322	10.700678	10.008451	9.991549	44	56
5	15	9.291029	10.708971	9.299486	10.700514	10.008458	9.991542	45	55
6	30	9.291187	10.708813	9.299651	10.700349	10.008464	9.991536	30	54
7	45	9.291346	10.708654	9.299816	10.700184	10.008470	9.991530	15	53
8	17	9.291504	10.708496	9.299980	10.700020	10.008476	9.991524	43	52
9	15	9.291662	10.708338	9.300145	10.699855	10.008483	9.991517	45	51
10	30	9.291820	10.708180	9.300309	10.699691	10.008489	9.991511	30	50
11	45	9.291979	10.708021	9.300474	10.699526	10.008495	9.991505	15	49
12	18	9.292137	10.707863	9.300638	10.699362	10.008502	9.991498	42	48
13	15	9.292295	10.707705	9.300803	10.699197	10.008508	9.991492	45	47
14	30	9.292453	10.707547	9.300967	10.699033	10.008514	9.991486	30	46
15	45	9.292611	10.707389	9.301131	10.698869	10.008521	9.991479	15	45
16	19	9.292768	10.707232	9.301295	10.698705	10.008527	9.991473	41	44
17	15	9.292926	10.707074	9.301459	10.698541	10.008533	9.991467	45	43
18	30	9.293084	10.706916	9.301623	10.698377	10.008540	9.991460	30	42
19	45	9.293242	10.706758	9.301787	10.698213	10.008546	9.991454	15	41
20	20	9.293399	10.706601	9.301951	10.698049	10.008552	9.991448	40	40
21	15	9.293557	10.706443	9.302115	10.697885	10.008559	9.991441	45	39
22	30	9.293714	10.706286	9.302279	10.697721	10.008565	9.991435	30	38
23	45	9.293872	10.706128	9.302443	10.697557	10.008571	9.991429	15	37
24	21	9.294029	10.705971	9.302607	10.697393	10.008578	9.991422	39	36
25	15	9.294186	10.705814	9.302770	10.697230	10.008584	9.991416	45	35
26	30	9.294344	10.705656	9.302934	10.697066	10.008590	9.991410	30	34
27	45	9.294501	10.705499	9.303097	10.696903	10.008597	9.991403	15	33
28	22	9.294658	10.705342	9.303261	10.696739	10.008603	9.991397	38	32
29	15	9.294815	10.705185	9.303424	10.696576	10.008609	9.991391	45	31
30	30	9.294972	10.705028	9.303588	10.696412	10.008616	9.991384	30	30
31	45	9.295129	10.704871	9.303751	10.696249	10.008622	9.991378	15	29
32	23	9.295286	10.704714	9.303914	10.696086	10.008628	9.991372	37	28
33	15	9.295443	10.704557	9.304077	10.695923	10.008635	9.991365	45	27
34	30	9.295600	10.704400	9.304241	10.695759	10.008641	9.991359	30	26
35	45	9.295756	10.704244	9.304404	10.695596	10.008647	9.991353	15	25
36	24	9.295913	10.704087	9.304567	10.695433	10.008654	9.991346	36	24
37	15	9.296070	10.703930	9.304730	10.695270	10.008660	9.991340	45	23
38	30	9.296226	10.703774	9.304893	10.695107	10.008667	9.991333	30	22
39	45	9.296383	10.703617	9.305055	10.694945	10.008673	9.991327	15	21
40	25	9.296539	10.703461	9.305218	10.694782	10.008679	9.991321	35	20
41	15	9.296695	10.703305	9.305381	10.694619	10.008686	9.991314	45	19
42	30	9.296852	10.703148	9.305544	10.694456	10.008692	9.991308	30	18
43	45	9.297008	10.702992	9.305706	10.694294	10.008698	9.991302	15	17
44	26	9.297164	10.702836	9.305869	10.694131	10.008705	9.991295	34	16
45	15	9.297320	10.702680	9.306031	10.693969	10.008711	9.991289	45	15
46	30	9.297476	10.702524	9.306194	10.693806	10.008718	9.991282	30	14
47	45	9.297632	10.702368	9.306356	10.693644	10.008724	9.991276	15	13
48	27	9.297788	10.702212	9.306519	10.693481	10.008730	9.991270	33	12
49	15	9.297944	10.702056	9.306681	10.693319	10.008737	9.991263	45	11
50	30	9.298100	10.701900	9.306843	10.693157	10.008743	9.991257	30	10
51	45	9.298256	10.701744	9.307005	10.692995	10.008750	9.991250	15	9
52	28	9.298412	10.701588	9.307167	10.692833	10.008756	9.991244	32	8
53	15	9.298567	10.701433	9.307330	10.692670	10.008762	9.991238	45	7
54	30	9.298723	10.701277	9.307492	10.692508	10.008769	9.991231	30	6
55	45	9.298878	10.701122	9.307654	10.692346	10.008775	9.991225	15	5
56	29	9.299034	10.700966	9.307815	10.692185	10.008782	9.991218	31	4
57	15	9.299189	10.700811	9.307977	10.692023	10.008788	9.991212	45	3
58	30	9.299345	10.700655	9.308139	10.691861	10.008794	9.991206	30	2
59	45	9.299500	10.700500	9.308301	10.691699	10.008801	9.991199	15	1
60	30	9.299655	10.700345	9.308463	10.691537	10.008807	9.991193	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
5 ^h 14 ^m .			LOG. SINES, &c.				78 deg		

0 ^h 46 ^m .		LOG. SINES, &c. (t.)						11 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	30	9.299655	10.700345	9.308463	10.691537	10.008807	9.991193	30		60
1	15	9.299810	10.700190	9.308624	10.691376	10.008814	9.991186	45		59
2	30	9.299966	10.700034	9.308786	10.691214	10.008820	9.991180	30		58
3	45	9.300121	10.699879	9.308947	10.691053	10.008827	9.991173	15		57
4	31	9.300276	10.699724	9.309109	10.690891	10.008833	9.991167	29		56
5	15	9.300431	10.699569	9.309270	10.690730	10.008840	9.991160	45		55
6	30	9.300586	10.699414	9.309432	10.690568	10.008846	9.991154	30		54
7	45	9.300740	10.699260	9.309593	10.690407	10.008852	9.991148	15		53
8	32	9.300895	10.699105	9.309754	10.690246	10.008859	9.991141	28		52
9	15	9.301050	10.698950	9.309915	10.690085	10.008865	9.991135	45		51
10	30	9.301205	10.698795	9.310076	10.689924	10.008872	9.991128	30		50
11	45	9.301359	10.698641	9.310237	10.689763	10.008878	9.991122	15		49
12	33	9.301514	10.698486	9.310398	10.689602	10.008885	9.991115	27		48
13	15	9.301668	10.698332	9.310559	10.689441	10.008891	9.991109	45		47
14	30	9.301823	10.698177	9.310720	10.689280	10.008898	9.991102	30		46
15	45	9.301977	10.698023	9.310881	10.689119	10.008904	9.991096	15		45
16	34	9.302132	10.697868	9.311042	10.688958	10.008910	9.991090	26		44
17	15	9.302286	10.697714	9.311203	10.688797	10.008917	9.991083	45		43
18	30	9.302440	10.697560	9.311363	10.688637	10.008923	9.991077	30		42
19	45	9.302594	10.697406	9.311524	10.688476	10.008930	9.991070	15		41
20	35	9.302748	10.697252	9.311685	10.688315	10.008936	9.991064	25		40
21	15	9.302903	10.697097	9.311845	10.688155	10.008943	9.991057	45		39
22	30	9.303057	10.696943	9.312006	10.687994	10.008949	9.991051	30		38
23	45	9.303210	10.696790	9.312166	10.687834	10.008956	9.991044	15		37
24	36	9.303364	10.696636	9.312327	10.687673	10.008962	9.991038	24		36
25	15	9.303518	10.696482	9.312487	10.687513	10.008969	9.991031	45		35
26	30	9.303672	10.696328	9.312647	10.687353	10.008975	9.991025	30		34
27	45	9.303826	10.696174	9.312807	10.687193	10.008982	9.991018	15		33
28	37	9.303979	10.696021	9.312967	10.687033	10.008988	9.991012	23		32
29	15	9.304133	10.695867	9.313128	10.686872	10.008995	9.991005	45		31
30	30	9.304286	10.695714	9.313288	10.686712	10.009001	9.990999	30		30
31	45	9.304440	10.695560	9.313448	10.686552	10.009008	9.990992	15		29
32	38	9.304593	10.695407	9.313608	10.686392	10.009014	9.990986	22		28
33	15	9.304747	10.695253	9.313767	10.686233	10.009021	9.990979	45		27
34	30	9.304900	10.695100	9.313927	10.686073	10.009027	9.990973	30		26
35	45	9.305053	10.694947	9.314087	10.685913	10.009034	9.990966	15		25
36	39	9.305207	10.694793	9.314247	10.685753	10.009040	9.990960	21		24
37	15	9.305360	10.694640	9.314406	10.685594	10.009047	9.990953	45		23
38	30	9.305513	10.694487	9.314566	10.685434	10.009053	9.990947	30		22
39	45	9.305666	10.694334	9.314726	10.685274	10.009060	9.990940	15		21
40	40	9.305819	10.694181	9.314885	10.685115	10.009066	9.990934	20		20
41	15	9.305972	10.694028	9.315045	10.684955	10.009073	9.990927	45		19
42	30	9.306125	10.693875	9.315204	10.684796	10.009079	9.990921	30		18
43	45	9.306277	10.693723	9.315363	10.684637	10.009086	9.990914	15		17
44	41	9.306430	10.693570	9.315523	10.684477	10.009092	9.990908	19		16
45	15	9.306583	10.693417	9.315682	10.684318	10.009099	9.990901	45		15
46	30	9.306736	10.693264	9.315841	10.684159	10.009105	9.990895	30		14
47	45	9.306888	10.693112	9.316000	10.684000	10.009112	9.990888	15		13
48	42	9.307041	10.692959	9.316159	10.683841	10.009119	9.990881	18		12
49	15	9.307193	10.692807	9.316318	10.683682	10.009125	9.990875	45		11
50	30	9.307346	10.692654	9.316477	10.683523	10.009132	9.990868	30		10
51	45	9.307498	10.692502	9.316636	10.683364	10.009138	9.990862	15		9
52	43	9.307650	10.692350	9.316795	10.683205	10.009145	9.990855	17		8
53	15	9.307803	10.692197	9.316954	10.683046	10.009151	9.990849	45		7
54	30	9.307955	10.692045	9.317112	10.682888	10.009158	9.990842	30		6
55	45	9.308107	10.691893	9.317271	10.682729	10.009164	9.990836	15		5
56	44	9.308259	10.691741	9.317430	10.682570	10.009171	9.990829	16		4
57	15	9.308411	10.691589	9.317588	10.682412	10.009177	9.990823	45		3
58	30	9.308563	10.691437	9.317747	10.682253	10.009184	9.990816	30		2
59	45	9.308715	10.691285	9.317905	10.682095	10.009191	9.990809	15		1
60	45	9.308867	10.691133	9.318064	10.681936	10.009197	9.990803	15		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
5 ^h 13 ^m		LOG. SINES, &c.						78 deg.		

0 ^h 47 ^m		LOG. SINES, &c. (t)						11 deg	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.308867	10.691133	9.318064	10.681936	10.009197	9.990803	15	60
1	15	9.309019	10.690981	9.318222	10.681778	10.009204	9.990796	45	59
2	30	9.309170	10.690830	9.318381	10.681619	10.009210	9.990790	30	58
3	45	9.309322	10.690678	9.318539	10.681461	10.009217	9.990783	15	57
4	46	9.309474	10.690526	9.318697	10.681303	10.009223	9.990777	14	56
5	15	9.309625	10.690375	9.318855	10.681145	10.009230	9.990770	45	55
6	30	9.309777	10.690223	9.319013	10.680987	10.009237	9.990763	30	54
7	45	9.309928	10.690072	9.319171	10.680829	10.009243	9.990757	15	53
8	47	9.310080	10.689920	9.319329	10.680671	10.009250	9.990750	13	52
9	15	9.310231	10.689769	9.319487	10.680513	10.009256	9.990744	45	51
10	30	9.310382	10.689618	9.319645	10.680355	10.009263	9.990737	30	50
11	45	9.310534	10.689466	9.319803	10.680197	10.009270	9.990730	15	49
12	48	9.310685	10.689315	9.319961	10.680039	10.009276	9.990724	12	48
13	15	9.310836	10.689164	9.320119	10.679881	10.009283	9.990717	45	47
14	30	9.310987	10.689013	9.320276	10.679724	10.009289	9.990711	30	46
15	45	9.311138	10.688862	9.320434	10.679566	10.009296	9.990704	15	45
16	49	9.311289	10.688711	9.320592	10.679408	10.009303	9.990697	11	44
17	15	9.311440	10.688560	9.320749	10.679251	10.009309	9.990691	45	43
18	30	9.311591	10.688409	9.320907	10.679093	10.009316	9.990684	30	42
19	45	9.311742	10.688258	9.321064	10.678936	10.009322	9.990678	15	41
20	50	9.311893	10.688107	9.321222	10.678778	10.009329	9.990671	10	40
21	15	9.312043	10.687957	9.321379	10.678621	10.009336	9.990664	45	39
22	30	9.312194	10.687806	9.321536	10.678464	10.009342	9.990658	30	38
23	45	9.312345	10.687655	9.321693	10.678307	10.009349	9.990651	15	37
24	51	9.312495	10.687505	9.321851	10.678149	10.009356	9.990644	9	36
25	15	9.312646	10.687354	9.322008	10.677992	10.009362	9.990638	45	35
26	30	9.312796	10.687204	9.322165	10.677835	10.009369	9.990631	30	34
27	45	9.312946	10.687054	9.322322	10.677678	10.009375	9.990625	15	33
28	52	9.313097	10.686903	9.322479	10.677521	10.009382	9.990618	8	32
29	15	9.313247	10.686753	9.322636	10.677364	10.009389	9.990611	45	31
30	30	9.313397	10.686603	9.322793	10.677207	10.009395	9.990605	30	30
31	45	9.313547	10.686453	9.322949	10.677051	10.009402	9.990598	15	29
32	53	9.313698	10.686302	9.323106	10.676894	10.009409	9.990591	7	28
33	15	9.313848	10.686152	9.323263	10.676737	10.009415	9.990585	45	27
34	30	9.313998	10.686002	9.323419	10.676581	10.009422	9.990578	30	26
35	45	9.314148	10.685852	9.323576	10.676424	10.009429	9.990571	15	25
36	54	9.314297	10.685703	9.323733	10.676267	10.009435	9.990565	6	24
37	15	9.314447	10.685553	9.323889	10.676111	10.009442	9.990558	45	23
38	30	9.314597	10.685403	9.324046	10.675954	10.009449	9.990551	30	22
39	45	9.314747	10.685253	9.324202	10.675798	10.009455	9.990545	15	21
40	55	9.314896	10.685104	9.324358	10.675642	10.009462	9.990538	5	20
41	15	9.315046	10.684954	9.324515	10.675485	10.009469	9.990531	45	19
42	30	9.315196	10.684804	9.324671	10.675329	10.009475	9.990525	30	1
43	45	9.315345	10.684655	9.324827	10.675173	10.009482	9.990518	15	17
44	56	9.315495	10.684505	9.324983	10.675017	10.009489	9.990511	4	16
45	15	9.315644	10.684356	9.325139	10.674861	10.009495	9.990505	45	15
46	30	9.315793	10.684207	9.325295	10.674705	10.009502	9.990498	30	14
47	45	9.315943	10.684057	9.325451	10.674549	10.009509	9.990491	15	13
48	57	9.316092	10.683908	9.325607	10.674393	10.009515	9.990485	3	12
49	15	9.316241	10.683759	9.325763	10.674237	10.009522	9.990478	45	11
50	30	9.316390	10.683610	9.325919	10.674081	10.009529	9.990471	30	10
51	45	9.316539	10.683461	9.326075	10.673925	10.009535	9.990465	15	9
52	58	9.316688	10.683312	9.326230	10.673770	10.009542	9.990458	2	8
53	15	9.316837	10.683163	9.326386	10.673614	10.009549	9.990451	45	7
54	30	9.316986	10.683014	9.326542	10.673458	10.009555	9.990445	30	6
55	45	9.317135	10.682865	9.326697	10.673303	10.009562	9.990438	15	5
56	59	9.317284	10.682716	9.326853	10.673147	10.009569	9.990431	1	4
57	15	9.317433	10.682567	9.327008	10.672992	10.009576	9.990424	45	3
58	30	9.317582	10.682418	9.327164	10.672836	10.009582	9.990418	30	2
59	45	9.317730	10.682270	9.327319	10.672681	10.009589	9.990411	15	1
60	60	9.317879	10.682121	9.327474	10.672526	10.009596	9.990404	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 12 ^m		LOG. SINES, &c.						78 deg.	

0 ^h 48 ^m .		LOG. SINES, &c. (t.)						12 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.317879	10.682121	9.327474	10.672526	10.009596	9.990404	60	60
1	15	9.318027	10.681973	9.327630	10.672370	10.009602	9.990398	45	59
2	30	9.318176	10.681824	9.327785	10.672215	10.009609	9.990391	30	58
3	45	9.318324	10.681676	9.327940	10.672060	10.009616	9.990384	15	57
4	1	9.318473	10.681527	9.328095	10.671905	10.009623	9.990377	59	56
5	15	9.318621	10.681379	9.328250	10.671750	10.009629	9.990371	45	55
6	30	9.318769	10.681231	9.328405	10.671595	10.009636	9.990364	30	54
7	45	9.318918	10.681082	9.328560	10.671440	10.009643	9.990357	15	53
8	2	9.319066	10.680934	9.328715	10.671285	10.009649	9.990351	58	52
9	15	9.319214	10.680786	9.328870	10.671130	10.009656	9.990344	45	51
10	30	9.319362	10.680638	9.329025	10.670975	10.009663	9.990337	30	50
11	45	9.319510	10.680490	9.329180	10.670820	10.009670	9.990330	15	49
12	3	9.319658	10.680342	9.329334	10.670666	10.009676	9.990324	57	48
13	15	9.319806	10.680194	9.329489	10.670511	10.009683	9.990317	45	47
14	30	9.319954	10.680046	9.329644	10.670356	10.009690	9.990310	30	46
15	45	9.320102	10.679898	9.329798	10.670202	10.009697	9.990303	15	45
16	4	9.320249	10.679751	9.329953	10.670047	10.009703	9.990297	56	44
17	15	9.320397	10.679603	9.330107	10.669893	10.009710	9.990290	45	43
18	30	9.320545	10.679455	9.330262	10.669738	10.009717	9.990283	30	42
19	45	9.320692	10.679308	9.330416	10.669584	10.009724	9.990276	15	41
20	5	9.320840	10.679160	9.330570	10.669430	10.009730	9.990270	55	40
21	15	9.320987	10.679013	9.330725	10.669275	10.009737	9.990263	45	39
22	30	9.321135	10.678865	9.330879	10.669121	10.009744	9.990256	30	38
23	45	9.321282	10.678718	9.331033	10.668967	10.009751	9.990249	15	37
24	6	9.321430	10.678570	9.331187	10.668813	10.009757	9.990243	54	36
25	15	9.321577	10.678423	9.331341	10.668659	10.009764	9.990236	45	35
26	30	9.321724	10.678276	9.331495	10.668505	10.009771	9.990229	30	34
27	45	9.321871	10.678129	9.331649	10.668351	10.009778	9.990222	15	33
28	7	9.322019	10.677981	9.331803	10.668197	10.009785	9.990215	53	32
29	15	9.322166	10.677834	9.331957	10.668043	10.009791	9.990209	45	31
30	30	9.322313	10.677687	9.332111	10.667889	10.009798	9.990202	30	30
31	45	9.322460	10.677540	9.332265	10.667735	10.009805	9.990195	15	29
32	8	9.322607	10.677393	9.332418	10.667582	10.009812	9.990188	52	28
33	15	9.322753	10.677247	9.332572	10.667428	10.009818	9.990182	45	27
34	30	9.322900	10.677100	9.332726	10.667274	10.009825	9.990175	30	26
35	45	9.323047	10.676953	9.332879	10.667121	10.009832	9.990168	15	25
36	9	9.323194	10.676806	9.333033	10.666967	10.009839	9.990161	51	24
37	15	9.323340	10.676660	9.333186	10.666814	10.009846	9.990154	45	23
38	30	9.323487	10.676513	9.333340	10.666660	10.009852	9.990148	30	22
39	45	9.323634	10.676366	9.333493	10.666507	10.009859	9.990141	15	21
40	10	9.323780	10.676220	9.333646	10.666354	10.009866	9.990134	50	20
41	15	9.323927	10.676073	9.333799	10.666201	10.009873	9.990127	45	19
42	30	9.324073	10.675927	9.333953	10.666047	10.009880	9.990120	30	18
43	45	9.324219	10.675781	9.334106	10.665894	10.009887	9.990113	15	17
44	11	9.324366	10.675634	9.334259	10.665741	10.009893	9.990107	49	16
45	15	9.324512	10.675488	9.334412	10.665588	10.009900	9.990100	45	15
46	30	9.324658	10.675342	9.334565	10.665435	10.009907	9.990093	30	14
47	45	9.324804	10.675196	9.334718	10.665282	10.009914	9.990086	15	13
48	12	9.324950	10.675050	9.334871	10.665129	10.009921	9.990079	48	12
49	15	9.325096	10.674904	9.335024	10.664976	10.009927	9.990073	45	11
50	30	9.325242	10.674758	9.335177	10.664823	10.009934	9.990066	30	10
51	45	9.325388	10.674612	9.335330	10.664670	10.009941	9.990059	15	9
52	13	9.325534	10.674466	9.335482	10.664518	10.009948	9.990052	47	8
53	15	9.325680	10.674320	9.335635	10.664365	10.009955	9.990045	45	7
54	30	9.325826	10.674174	9.335788	10.664212	10.009962	9.990038	30	6
55	45	9.325972	10.674028	9.335940	10.664060	10.009969	9.990031	15	5
56	14	9.326117	10.673883	9.336093	10.663907	10.009975	9.990025	46	4
57	15	9.326263	10.673737	9.336245	10.663755	10.009982	9.990018	45	3
58	30	9.326409	10.673591	9.336398	10.663602	10.009989	9.990011	30	2
59	45	9.326554	10.673446	9.336550	10.663450	10.009996	9.990004	15	1
60	15	9.326700	10.673300	9.336702	10.663298	10.010003	9.989997	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 11 ^m .		LOG. SINES, &c.						77 deg.	

0 ^h 49 ^m .		LOG. SINBS, &c. (t.)						12 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.326700	10.673300	9.336702	10.663298	10.010003	9.989997	45	60
1	15	9.326845	10.673155	9.336855	10.663145	10.010010	9.989990	45	59
2	30	9.326990	10.673010	9.337007	10.662993	10.010016	9.989984	30	58
3	45	9.327136	10.672864	9.337159	10.662841	10.010023	9.989977	15	57
4	16	9.327281	10.672719	9.337311	10.662689	10.010030	9.989970	44	56
5	15	9.327426	10.672574	9.337463	10.662537	10.010037	9.989963	45	55
6	30	9.327571	10.672429	9.337615	10.662385	10.010044	9.989956	30	54
7	45	9.327717	10.672283	9.337767	10.662233	10.010051	9.989949	15	53
8	17	9.327862	10.672138	9.337919	10.662081	10.010058	9.989942	43	52
9	15	9.328007	10.671993	9.338071	10.661929	10.010065	9.989935	45	51
10	30	9.328152	10.671848	9.338223	10.661777	10.010071	9.989929	30	50
11	45	9.328297	10.671703	9.338375	10.661625	10.010078	9.989922	15	49
12	18	9.328442	10.671558	9.338527	10.661473	10.010085	9.989915	42	48
13	15	9.328586	10.671414	9.338780	10.661322	10.010092	9.989908	45	47
14	30	9.328731	10.671269	9.338830	10.661170	10.010099	9.989901	30	46
15	45	9.328876	10.671124	9.338982	10.661018	10.010106	9.989894	15	45
16	19	9.329021	10.670979	9.339133	10.660867	10.010113	9.989887	41	44
17	15	9.329165	10.670835	9.339285	10.660715	10.010120	9.989880	45	43
18	30	9.329310	10.670690	9.339436	10.660564	10.010127	9.989873	30	42
19	45	9.329454	10.670546	9.339588	10.660412	10.010133	9.989867	15	41
20	20	9.329599	10.670401	9.339739	10.660261	10.010140	9.989860	40	40
21	15	9.329743	10.670257	9.339890	10.660110	10.010147	9.989853	45	39
22	30	9.329887	10.670113	9.340042	10.659958	10.010154	9.989846	30	38
23	45	9.330032	10.669968	9.340193	10.659807	10.010161	9.989839	15	37
24	21	9.330176	10.669824	9.340344	10.659656	10.010168	9.989832	39	36
25	15	9.330320	10.669680	9.340495	10.659505	10.010175	9.989825	45	35
26	30	9.330464	10.669536	9.340646	10.659354	10.010182	9.989818	30	34
27	45	9.330609	10.669391	9.340797	10.659203	10.010189	9.989811	15	33
28	22	9.330753	10.669247	9.340948	10.659052	10.010196	9.989804	38	32
29	15	9.330897	10.669103	9.341099	10.658901	10.010203	9.989797	45	31
30	30	9.331041	10.668959	9.341250	10.658750	10.010210	9.989790	30	30
31	45	9.331185	10.668815	9.341401	10.658599	10.010216	9.989784	15	29
32	23	9.331328	10.668672	9.341552	10.658448	10.010223	9.989777	37	28
33	15	9.331472	10.668528	9.341703	10.658297	10.010230	9.989770	45	27
34	30	9.331616	10.668384	9.341853	10.658147	10.010237	9.989763	30	26
35	45	9.331760	10.668240	9.342004	10.657996	10.010244	9.989756	15	25
36	24	9.331903	10.668097	9.342155	10.657845	10.010251	9.989749	36	24
37	15	9.332047	10.667953	9.342305	10.657695	10.010258	9.989742	45	23
38	30	9.332191	10.667809	9.342456	10.657544	10.010265	9.989735	30	22
39	45	9.332334	10.667666	9.342606	10.657394	10.010272	9.989728	15	21
40	25	9.332478	10.667522	9.342757	10.657243	10.010279	9.989721	35	20
41	15	9.332621	10.667379	9.342907	10.657093	10.010286	9.989714	45	19
42	30	9.332764	10.667236	9.343057	10.656943	10.010293	9.989707	30	18
43	45	9.332908	10.667092	9.343208	10.656792	10.010300	9.989700	15	17
44	26	9.333051	10.666949	9.343358	10.656642	10.010307	9.989693	34	16
45	15	9.333194	10.666806	9.343508	10.656492	10.010314	9.989686	45	15
46	30	9.333337	10.666663	9.343658	10.656342	10.010321	9.989679	30	14
47	45	9.333481	10.666519	9.343808	10.656192	10.010328	9.989672	15	13
48	27	9.333624	10.666376	9.343958	10.656042	10.010335	9.989665	33	12
49	15	9.333767	10.666233	9.344108	10.655892	10.010342	9.989658	45	11
50	30	9.333910	10.666090	9.344258	10.655742	10.010349	9.989651	30	10
51	45	9.334053	10.665947	9.344408	10.655592	10.010356	9.989644	15	9
52	28	9.334195	10.665805	9.344558	10.655442	10.010363	9.989637	32	8
53	15	9.334338	10.665662	9.344708	10.655292	10.010370	9.989630	45	7
54	30	9.334481	10.665519	9.344858	10.655142	10.010377	9.989623	30	6
55	45	9.334624	10.665376	9.345007	10.654993	10.010384	9.989616	15	5
56	29	9.334766	10.665234	9.345157	10.654843	10.010391	9.989609	31	4
57	15	9.334909	10.665091	9.345307	10.654693	10.010398	9.989602	45	3
58	30	9.335052	10.664948	9.345456	10.654544	10.010405	9.989595	30	2
59	45	9.335194	10.664806	9.345606	10.654394	10.010412	9.989588	15	1
60	30	9.335337	10.664663	9.345755	10.654245	10.010419	9.989581	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 10 ^m .		LOG. SINES, &c.						77 deg.	

0 ^h 50 ^m .		LOG. SINES, &c. (t.)						12 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.335337	10.664663	9.345755	10.654245	10.010419	9.989581	30	66
1	15	9.335479	10.664521	9.345905	10.654095	10.010426	9.989574	45	59
2	30	9.335622	10.664378	9.346054	10.653946	10.010433	9.989567	30	58
3	45	9.335764	10.664236	9.346203	10.653797	10.010440	9.989560	15	57
4	31	9.335906	10.664094	9.346353	10.653647	10.010447	9.989553	29	56
5	15	9.336048	10.663952	9.346502	10.653498	10.010454	9.989546	45	55
6	30	9.336191	10.663809	9.346651	10.653349	10.010461	9.989539	30	54
7	45	9.336333	10.663667	9.346800	10.653200	10.010468	9.989532	15	53
8	32	9.336475	10.663525	9.346949	10.653051	10.010475	9.989525	28	52
9	15	9.336617	10.663383	9.347098	10.652902	10.010482	9.989518	45	51
10	30	9.336759	10.663241	9.347247	10.652753	10.010489	9.989511	30	50
11	45	9.336901	10.663099	9.347396	10.652604	10.010496	9.989504	15	49
12	33	9.337043	10.662957	9.347545	10.652455	10.010503	9.989497	27	48
13	15	9.337185	10.662815	9.347694	10.652306	10.010510	9.989490	45	47
14	30	9.337326	10.662674	9.347843	10.652157	10.010517	9.989483	30	46
15	45	9.337468	10.662532	9.347992	10.652008	10.010524	9.989476	15	45
16	34	9.337610	10.662390	9.348141	10.651859	10.010531	9.989469	26	44
17	15	9.337751	10.662249	9.348289	10.651711	10.010538	9.989462	45	43
18	30	9.337893	10.662107	9.348438	10.651562	10.010545	9.989455	30	42
19	45	9.338035	10.661965	9.348587	10.651413	10.010552	9.989448	15	41
20	35	9.338176	10.661824	9.348735	10.651265	10.010559	9.989441	25	40
21	15	9.338318	10.661682	9.348884	10.651116	10.010566	9.989434	45	39
22	30	9.338459	10.661541	9.349032	10.650968	10.010573	9.989427	30	38
23	45	9.338600	10.661400	9.349181	10.650819	10.010580	9.989420	15	37
24	36	9.338742	10.661258	9.349329	10.650671	10.010587	9.989413	24	36
25	15	9.338883	10.661117	9.349477	10.650523	10.010594	9.989406	45	35
26	30	9.339024	10.660976	9.349626	10.650374	10.010601	9.989399	30	34
27	45	9.339165	10.660835	9.349774	10.650226	10.010608	9.989392	15	33
28	37	9.339306	10.660694	9.349922	10.650078	10.010616	9.989384	23	32
29	15	9.339448	10.660552	9.350070	10.649930	10.010623	9.989377	45	31
30	30	9.339589	10.660411	9.350218	10.649782	10.010630	9.989370	30	30
31	45	9.339730	10.660270	9.350366	10.649634	10.010637	9.989363	15	29
32	38	9.339871	10.660129	9.350514	10.649486	10.010644	9.989356	22	28
33	15	9.340011	10.659989	9.350662	10.649338	10.010651	9.989349	45	27
34	30	9.340152	10.659848	9.350810	10.649190	10.010658	9.989342	30	26
35	45	9.340293	10.659707	9.350958	10.649042	10.010665	9.989335	15	25
36	39	9.340434	10.659566	9.351106	10.648894	10.010672	9.989328	21	24
37	15	9.340574	10.659426	9.351254	10.648746	10.010679	9.989321	45	23
38	30	9.340715	10.659285	9.351401	10.648599	10.010686	9.989314	30	22
39	45	9.340856	10.659144	9.351549	10.648451	10.010693	9.989307	15	21
40	40	9.340996	10.659004	9.351697	10.648303	10.010701	9.989299	20	20
41	15	9.341137	10.658863	9.351844	10.648156	10.010708	9.989292	45	19
42	30	9.341277	10.658723	9.351992	10.648008	10.010715	9.989285	30	18
43	45	9.341418	10.658582	9.352139	10.647861	10.010722	9.989278	15	17
44	41	9.341558	10.658442	9.352287	10.647713	10.010729	9.989271	19	16
45	15	9.341698	10.658302	9.352434	10.647566	10.010736	9.989264	45	15
46	30	9.341839	10.658161	9.352582	10.647418	10.010743	9.989257	30	14
47	45	9.341979	10.658021	9.352729	10.647271	10.010750	9.989250	15	13
48	42	9.342119	10.657881	9.352876	10.647124	10.010757	9.989243	18	12
49	15	9.342259	10.657741	9.353024	10.646976	10.010765	9.989235	45	11
50	30	9.342399	10.657601	9.353171	10.646829	10.010772	9.989228	30	10
51	45	9.342539	10.657461	9.353318	10.646682	10.010779	9.989221	15	9
52	43	9.342679	10.657321	9.353465	10.646535	10.010786	9.989214	17	8
53	15	9.342819	10.657181	9.353612	10.646388	10.010793	9.989207	45	7
54	30	9.342959	10.657041	9.353759	10.646241	10.010800	9.989200	30	6
55	45	9.343099	10.656901	9.353906	10.646094	10.010807	9.989193	15	5
56	44	9.343239	10.656761	9.354053	10.645947	10.010814	9.989186	16	4
57	15	9.343378	10.656622	9.354200	10.645800	10.010822	9.989178	45	3
58	30	9.343518	10.656482	9.354347	10.645653	10.010829	9.989171	30	2
59	45	9.343658	10.656342	9.354493	10.645507	10.010836	9.989164	15	1
60	45	9.343797	10.656203	9.354640	10.645360	10.010843	9.989157	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

5^h 9^m.

LOG. SINES, &c.

77 deg.

0 ^h 51 ^m .		LOG. SINES, &c. (t.)					12 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	45	9.343797	10.656203	9.354640	10.645360	10.010843	9.989157	15		60
1	15	9.343937	10.656063	9.354787	10.645213	10.010850	9.989150	45		59
2	30	9.344076	10.655924	9.354934	10.645066	10.010857	9.989143	30		58
3	45	9.344216	10.655784	9.355080	10.644920	10.010864	9.989136	15		57
4	46	9.344355	10.655645	9.355227	10.644773	10.010872	9.989128	14		56
5	15	9.344495	10.655505	9.355373	10.644627	10.010879	9.989121	45		55
6	30	9.344634	10.655366	9.355520	10.644480	10.010886	9.989114	30		54
7	45	9.344773	10.655227	9.355666	10.644334	10.010893	9.989107	15		53
8	47	9.344912	10.655088	9.355813	10.644187	10.010900	9.989100	13		52
9	15	9.345052	10.654948	9.355959	10.644041	10.010907	9.989093	45		51
10	30	9.345191	10.654809	9.356105	10.643895	10.010915	9.989085	30		50
11	45	9.345330	10.654670	9.356251	10.643749	10.010922	9.989078	15		49
12	48	9.345469	10.654531	9.356398	10.643602	10.010929	9.989071	12		48
13	15	9.345608	10.654392	9.356544	10.643456	10.010936	9.989064	45		47
14	30	9.345747	10.654253	9.356690	10.643310	10.010943	9.989057	30		46
15	45	9.345886	10.654114	9.356836	10.643164	10.010950	9.989050	15		45
16	49	9.346024	10.653976	9.356982	10.643018	10.010958	9.989042	11		44
17	15	9.346163	10.653837	9.357128	10.642872	10.010965	9.989035	45		43
18	30	9.346302	10.653698	9.357274	10.642726	10.010972	9.989028	30		42
19	45	9.346441	10.653559	9.357420	10.642580	10.010979	9.989021	15		41
20	50	9.346579	10.653421	9.357566	10.642434	10.010986	9.989014	10		40
21	15	9.346718	10.653282	9.357712	10.642288	10.010994	9.989006	45		39
22	30	9.346857	10.653143	9.357857	10.642143	10.011001	9.988999	30		38
23	45	9.346995	10.653005	9.358003	10.641997	10.011008	9.988992	15		37
24	51	9.347134	10.652866	9.358149	10.641851	10.011015	9.988985	9		36
25	15	9.347272	10.652728	9.358294	10.641706	10.011022	9.988978	45		35
26	30	9.347410	10.652590	9.358440	10.641560	10.011030	9.988970	30		34
27	45	9.347549	10.652451	9.358585	10.641415	10.011037	9.988963	15		33
28	52	9.347687	10.652313	9.358731	10.641269	10.011044	9.988956	8		32
29	15	9.347825	10.652175	9.358876	10.641124	10.011051	9.988949	45		31
30	30	9.347963	10.652037	9.359022	10.640978	10.011058	9.988942	30		30
31	45	9.348102	10.651898	9.359167	10.640833	10.011066	9.988934	15		29
32	53	9.348240	10.651760	9.359313	10.640687	10.011073	9.988927	7		28
33	15	9.348378	10.651622	9.359458	10.640542	10.011080	9.988920	45		27
34	30	9.348516	10.651484	9.359603	10.640397	10.011087	9.988913	30		26
35	45	9.348654	10.651346	9.359748	10.640252	10.011095	9.988905	15		25
36	54	9.348792	10.651208	9.359893	10.640107	10.011102	9.988898	6		24
37	15	9.348930	10.651070	9.360039	10.639961	10.011109	9.988891	45		23
38	30	9.349067	10.650933	9.360184	10.639816	10.011116	9.988884	30		22
39	45	9.349205	10.650795	9.360329	10.639671	10.011124	9.988876	15		21
40	55	9.349343	10.650657	9.360474	10.639526	10.011131	9.988869	5		20
41	15	9.349481	10.650519	9.360619	10.639381	10.011138	9.988862	45		19
42	30	9.349618	10.650382	9.360763	10.639237	10.011145	9.988855	30		18
43	45	9.349756	10.650244	9.360908	10.639092	10.011153	9.988847	15		17
44	56	9.349893	10.650107	9.361053	10.638947	10.011160	9.988840	4		16
45	15	9.350031	10.649969	9.361198	10.638802	10.011167	9.988833	45		15
46	30	9.350168	10.649832	9.361343	10.638657	10.011174	9.988826	30		14
47	45	9.350306	10.649694	9.361487	10.638513	10.011182	9.988818	15		13
48	57	9.350443	10.649557	9.361632	10.638368	10.011189	9.988811	3		12
49	15	9.350580	10.649420	9.361776	10.638224	10.011196	9.988804	45		11
50	30	9.350718	10.649282	9.361921	10.638079	10.011203	9.988797	30		10
51	45	9.350855	10.649145	9.362065	10.637935	10.011211	9.988789	15		9
52	58	9.350992	10.649008	9.362210	10.637790	10.011218	9.988782	2		8
53	15	9.351129	10.648871	9.362354	10.637646	10.011225	9.988775	45		7
54	30	9.351266	10.648734	9.362499	10.637501	10.011232	9.988768	30		6
55	45	9.351403	10.648597	9.362643	10.637357	10.011240	9.988760	15		5
56	59	9.351540	10.648460	9.362787	10.637213	10.011247	9.988753	1		4
57	15	9.351677	10.648323	9.362932	10.637068	10.011254	9.988746	45		3
58	30	9.351814	10.648186	9.363076	10.636924	10.011262	9.988738	30		2
59	45	9.351951	10.648049	9.363220	10.636780	10.011269	9.988731	15		1
60	60	9.352088	10.647912	9.363364	10.636636	10.011276	9.988724	0		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
5 ^h 5 ^m .		LOG. SINES, &c.					77 deg.			

0^h 52^m.

LOG. SINES, &c. (t.)

13 deg.

		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.		sec.
0	0	9.352088	10.647912	9.363364	10.636636	10.011276	9.988724	60	60
1	15	9.352225	10.647775	9.363508	10.636492	10.011283	9.988717	45	59
2	30	9.352361	10.647639	9.363652	10.636348	10.011291	9.988709	30	58
3	45	9.352498	10.647502	9.363796	10.636204	10.011298	9.988702	15	57
4	1	9.352635	10.647365	9.363940	10.636060	10.011305	9.988695	59	56
5	15	9.352771	10.647229	9.364084	10.635916	10.011313	9.988687	45	55
6	30	9.352908	10.647092	9.364228	10.635772	10.011320	9.988680	30	54
7	45	9.353044	10.646956	9.364372	10.635628	10.011327	9.988673	15	53
8	2	9.353181	10.646819	9.364515	10.635485	10.011335	9.988665	58	52
9	15	9.353317	10.646683	9.364659	10.635341	10.011342	9.988658	45	51
10	30	9.353454	10.646546	9.364803	10.635197	10.011349	9.988651	30	50
11	45	9.353590	10.646410	9.364946	10.635054	10.011356	9.988644	15	49
12	3	9.353726	10.646274	9.365090	10.634910	10.011364	9.988636	57	48
13	15	9.353863	10.646137	9.365234	10.634766	10.011371	9.988629	45	47
14	30	9.353999	10.646001	9.365377	10.634623	10.011378	9.988622	30	46
15	45	9.354135	10.645865	9.365521	10.634479	10.011386	9.988614	15	45
16	4	9.354271	10.645729	9.365664	10.634336	10.011393	9.988607	56	44
17	15	9.354407	10.645593	9.365807	10.634193	10.011400	9.988600	45	43
18	30	9.354543	10.645457	9.365951	10.634049	10.011408	9.988592	30	42
19	45	9.354679	10.645321	9.366094	10.633906	10.011415	9.988585	15	41
20	5	9.354815	10.645185	9.366237	10.633763	10.011422	9.988578	55	40
21	15	9.354951	10.645049	9.366381	10.633619	10.011430	9.988570	45	39
22	30	9.355087	10.644913	9.366524	10.633476	10.011437	9.988563	30	38
23	45	9.355222	10.644778	9.366667	10.633333	10.011444	9.988556	15	37
24	6	9.355358	10.644642	9.366810	10.633190	10.011452	9.988548	54	36
25	15	9.355494	10.644506	9.366953	10.633047	10.011459	9.988541	45	35
26	30	9.355630	10.644370	9.367096	10.632904	10.011467	9.988533	30	34
27	45	9.355765	10.644235	9.367239	10.632761	10.011474	9.988526	15	33
28	7	9.355901	10.644099	9.367382	10.632618	10.011481	9.988519	53	32
29	15	9.356036	10.643964	9.367525	10.632475	10.011489	9.988511	45	31
30	30	9.356172	10.643828	9.367668	10.632332	10.011496	9.988504	30	30
31	45	9.356307	10.643693	9.367810	10.632190	10.011503	9.988497	15	29
32	8	9.356443	10.643557	9.367953	10.632047	10.011511	9.988489	52	28
33	15	9.356578	10.643422	9.368096	10.631904	10.011518	9.988482	45	27
34	30	9.356713	10.643287	9.368239	10.631761	10.011525	9.988475	30	26
35	45	9.356848	10.643152	9.368381	10.631619	10.011533	9.988467	15	25
36	9	9.356984	10.643016	9.368524	10.631476	10.011540	9.988460	51	24
37	15	9.357119	10.642881	9.368666	10.631334	10.011548	9.988452	45	23
38	30	9.357254	10.642746	9.368809	10.631191	10.011555	9.988445	30	22
39	45	9.357389	10.642611	9.368951	10.631049	10.011562	9.988438	15	21
40	10	9.357524	10.642476	9.369094	10.630906	10.011570	9.988430	50	20
41	15	9.357659	10.642341	9.369236	10.630764	10.011577	9.988423	45	19
42	30	9.357794	10.642206	9.369378	10.630622	10.011584	9.988416	30	18
43	45	9.357929	10.642071	9.369521	10.630479	10.011592	9.988408	15	17
44	11	9.358064	10.641936	9.369663	10.630337	10.011599	9.988401	49	16
45	15	9.358198	10.641802	9.369805	10.630195	10.011607	9.988393	45	15
46	30	9.358333	10.641667	9.369947	10.630053	10.011614	9.988386	30	14
47	45	9.358468	10.641532	9.370089	10.629911	10.011621	9.988379	15	13
48	12	9.358603	10.641397	9.370231	10.629769	10.011629	9.988371	48	12
49	15	9.358737	10.641263	9.370374	10.629626	10.011636	9.988364	45	11
50	30	9.358872	10.641128	9.370516	10.629484	10.011644	9.988356	30	10
51	45	9.359006	10.640994	9.370657	10.629343	10.011651	9.988349	15	9
52	13	9.359141	10.640859	9.370799	10.629201	10.011659	9.988341	47	8
53	15	9.359275	10.640725	9.370941	10.629059	10.011666	9.988334	45	7
54	30	9.359410	10.640590	9.371083	10.628917	10.011673	9.988327	30	6
55	45	9.359544	10.640456	9.371225	10.628775	10.011681	9.988319	15	5
56	14	9.359678	10.640322	9.371367	10.628633	10.011688	9.988312	46	4
57	15	9.359813	10.640187	9.371508	10.628492	10.011696	9.988304	45	3
58	30	9.359947	10.640053	9.371650	10.628350	10.011703	9.988297	30	2
59	45	9.360081	10.639919	9.371792	10.628208	10.011711	9.988289	15	1
60	15	9.360215	10.639785	9.371933	10.628067	10.011718	9.988282	45	0
sec.		cosine.	secant.	cotangent	tangent.	cosecant.	sine.		sec.

5^h 7^m.

LOG. SINES, &c.

76 deg.

0 ^h 53 ^m .		LOG. SINES, &c. (t)						13 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"
0	15	9.360215	10.639785	9.371933	10.628067	10.011718	9.988282	4.	60
1	15	9.360349	10.639651	9.372075	10.627925	10.011725	9.988275	45	59
2	30	9.360483	10.639517	9.372216	10.627784	10.011733	9.988267	30	58
3	45	9.360617	10.639383	9.372358	10.627642	10.011740	9.988260	15	57
4	16	9.360751	10.639249	9.372499	10.627501	10.011748	9.988252	44	56
5	15	9.360885	10.639115	9.372641	10.627359	10.011755	9.988245	45	55
6	30	9.361019	10.638981	9.372782	10.627218	10.011763	9.988237	30	54
7	45	9.361153	10.638847	9.372923	10.627077	10.011770	9.988230	15	53
8	17	9.361287	10.638713	9.373064	10.626936	10.011778	9.988222	43	52
9	15	9.361421	10.638579	9.373206	10.626794	10.011785	9.988215	45	51
10	30	9.361554	10.638446	9.373347	10.626653	10.011792	9.988208	30	50
11	45	9.361688	10.638312	9.373488	10.626512	10.011800	9.988200	15	49
12	18	9.361822	10.638178	9.373629	10.626371	10.011807	9.988193	42	48
13	15	9.361955	10.638045	9.373770	10.626230	10.011815	9.988185	45	47
14	30	9.362089	10.637911	9.373911	10.626089	10.011822	9.988178	30	46
15	45	9.362222	10.637778	9.374052	10.625948	10.011830	9.988170	15	45
16	19	9.362356	10.637644	9.374193	10.625807	10.011837	9.988163	41	44
17	15	9.362489	10.637511	9.374334	10.625666	10.011845	9.988155	45	43
18	30	9.362623	10.637377	9.374475	10.625525	10.011852	9.988148	30	42
19	45	9.362756	10.637244	9.374616	10.625384	10.011860	9.988140	15	41
20	20	9.362889	10.637111	9.374756	10.625244	10.011867	9.988133	40	40
21	15	9.363022	10.636978	9.374897	10.625103	10.011875	9.988125	45	39
22	30	9.363156	10.636844	9.375038	10.624962	10.011882	9.988118	30	38
23	45	9.363289	10.636711	9.375178	10.624822	10.011890	9.988110	15	37
24	21	9.363422	10.636578	9.375319	10.624681	10.011897	9.988103	39	36
25	15	9.363555	10.636445	9.375459	10.624541	10.011905	9.988095	45	35
26	30	9.363688	10.636312	9.375600	10.624400	10.011912	9.988088	30	34
27	45	9.363821	10.636179	9.375740	10.624260	10.011920	9.988080	15	33
28	22	9.363954	10.636046	9.375881	10.624119	10.011927	9.988073	38	32
29	15	9.364087	10.635913	9.376021	10.623979	10.011935	9.988065	45	31
30	30	9.364220	10.635780	9.376162	10.623838	10.011942	9.988058	30	30
31	45	9.364352	10.635648	9.376302	10.623698	10.011950	9.988050	15	29
32	23	9.364485	10.635515	9.376442	10.623558	10.011957	9.988043	37	28
33	15	9.364618	10.635382	9.376583	10.623417	10.011965	9.988035	45	27
34	30	9.364751	10.635249	9.376723	10.623277	10.011972	9.988028	30	26
35	45	9.364883	10.635117	9.376863	10.623137	10.011980	9.988020	15	25
36	24	9.365016	10.634984	9.377003	10.622997	10.011987	9.988013	36	24
37	15	9.365148	10.634852	9.377143	10.622857	10.011995	9.988005	45	23
38	30	9.365281	10.634719	9.377283	10.622717	10.012002	9.987998	30	22
39	45	9.365413	10.634587	9.377423	10.622577	10.012010	9.987990	15	21
40	25	9.365546	10.634454	9.377563	10.622437	10.012017	9.987983	35	20
41	15	9.365678	10.634322	9.377703	10.622297	10.012025	9.987975	45	19
42	30	9.365810	10.634190	9.377843	10.622157	10.012032	9.987968	30	18
43	45	9.365943	10.634057	9.377983	10.622017	10.012040	9.987960	15	17
44	26	9.366075	10.633925	9.378122	10.621878	10.012048	9.987952	34	16
45	15	9.366207	10.633793	9.378262	10.621738	10.012055	9.987945	45	15
46	30	9.366339	10.633661	9.378402	10.621598	10.012063	9.987937	30	14
47	45	9.366471	10.633529	9.378542	10.621458	10.012070	9.987930	15	13
48	27	9.366604	10.633396	9.378681	10.621319	10.012078	9.987922	33	12
49	15	9.366736	10.633264	9.378821	10.621179	10.012085	9.987915	45	11
50	30	9.366868	10.633132	9.378960	10.621040	10.012093	9.987907	30	10
51	45	9.367000	10.633000	9.379100	10.620900	10.012100	9.987900	15	9
52	28	9.367131	10.632869	9.379239	10.620761	10.012108	9.987892	32	8
53	15	9.367263	10.632737	9.379379	10.620621	10.012116	9.987884	45	7
54	30	9.367395	10.632605	9.379518	10.620482	10.012123	9.987877	30	6
55	45	9.367527	10.632473	9.379658	10.620342	10.012131	9.987869	15	5
56	29	9.367659	10.632341	9.379797	10.620203	10.012138	9.987862	31	4
57	15	9.367790	10.632210	9.379936	10.620064	10.012146	9.987854	45	3
58	30	9.367922	10.632078	9.380075	10.619925	10.012153	9.987847	30	2
59	45	9.368054	10.631946	9.380215	10.619785	10.012161	9.987839	15	1
60	30	9.368185	10.631815	9.380354	10.619646	10.012169	9.987831	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine	"	sec
5 ^h 6 ^m .		LOG. SINES, &c.						76 deg.	

0 ^h 54 ^m .		LOG. SINES, &c. (t.)						13 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.368185	10.631815	9.380354	10.619646	10.012169	9.987831	30	60
1	15	9.368317	10.631683	9.380493	10.619507	10.012176	9.987824	45	59
2	30	9.368448	10.631552	9.380632	10.619368	10.012184	9.987816	30	58
3	45	9.368580	10.631420	9.380771	10.619229	10.012191	9.987809	15	57
4	31	9.368711	10.631289	9.380910	10.619090	10.012199	9.987801	29	56
5	15	9.368842	10.631158	9.381049	10.618951	10.012206	9.987794	45	55
6	30	9.368974	10.631026	9.381188	10.618812	10.012214	9.987786	30	54
7	45	9.369105	10.630895	9.381327	10.618673	10.012222	9.987778	15	53
8	32	9.369236	10.630764	9.381465	10.618535	10.012229	9.987771	28	52
9	15	9.369367	10.630633	9.381604	10.618396	10.012237	9.987763	45	51
10	30	9.369499	10.630501	9.381743	10.618257	10.012244	9.987756	30	50
11	45	9.369630	10.630370	9.381882	10.618118	10.012252	9.987748	15	49
12	33	9.369761	10.630239	9.382020	10.617980	10.012260	9.987740	27	48
13	15	9.369892	10.630108	9.382159	10.617841	10.012267	9.987733	45	47
14	30	9.370023	10.629977	9.382298	10.617702	10.012275	9.987725	30	46
15	45	9.370154	10.629846	9.382436	10.617564	10.012283	9.987717	15	45
16	34	9.370285	10.629715	9.382575	10.617425	10.012290	9.987710	26	44
17	15	9.370416	10.629584	9.382713	10.617287	10.012298	9.987702	45	43
18	30	9.370546	10.629454	9.382852	10.617148	10.012305	9.987695	30	42
19	45	9.370677	10.629323	9.382990	10.617010	10.012313	9.987687	15	41
20	35	9.370808	10.629192	9.383128	10.616872	10.012321	9.987679	25	40
21	15	9.370939	10.629061	9.383267	10.616733	10.012328	9.987672	45	39
22	30	9.371069	10.628931	9.383405	10.616595	10.012336	9.987664	30	38
23	45	9.371200	10.628800	9.383543	10.616457	10.012344	9.987656	15	37
24	36	9.371330	10.628670	9.383682	10.616318	10.012351	9.987649	24	36
25	15	9.371461	10.628539	9.383820	10.616180	10.012359	9.987641	45	35
26	30	9.371591	10.628409	9.383958	10.616042	10.012366	9.987634	30	34
27	45	9.371722	10.628278	9.384096	10.615904	10.012374	9.987626	15	33
28	37	9.371852	10.628148	9.384234	10.615766	10.012382	9.987618	23	32
29	15	9.371983	10.628017	9.384372	10.615628	10.012389	9.987611	45	31
30	30	9.372113	10.627887	9.384510	10.615490	10.012397	9.987603	30	30
31	45	9.372243	10.627757	9.384648	10.615352	10.012405	9.987595	15	29
32	38	9.372373	10.627627	9.384786	10.615214	10.012412	9.987588	22	28
33	15	9.372504	10.627496	9.384924	10.615076	10.012420	9.987580	45	27
34	30	9.372634	10.627366	9.385061	10.614939	10.012428	9.987572	30	26
35	45	9.372764	10.627236	9.385199	10.614801	10.012435	9.987565	15	25
36	39	9.372894	10.627106	9.385337	10.614663	10.012443	9.987557	21	24
37	15	9.373024	10.626976	9.385475	10.614525	10.012451	9.987549	45	23
38	30	9.373154	10.626846	9.385612	10.614388	10.012458	9.987542	30	22
39	45	9.373284	10.626716	9.385750	10.614250	10.012466	9.987534	15	21
40	40	9.373414	10.626586	9.385888	10.614112	10.012474	9.987526	20	20
41	15	9.373544	10.626456	9.386025	10.613975	10.012481	9.987519	45	19
42	30	9.373674	10.626326	9.386163	10.613837	10.012489	9.987511	30	18
43	45	9.373803	10.626197	9.386300	10.613700	10.012497	9.987503	15	17
44	41	9.373933	10.626067	9.386438	10.613562	10.012505	9.987495	19	16
45	15	9.374063	10.625937	9.386575	10.613425	10.012512	9.987488	45	15
46	30	9.374192	10.625808	9.386712	10.613288	10.012520	9.987480	30	14
47	45	9.374322	10.625678	9.386850	10.613150	10.012528	9.987472	15	13
48	42	9.374452	10.625548	9.386987	10.613013	10.012535	9.987465	18	12
49	15	9.374581	10.625419	9.387124	10.612876	10.012543	9.987457	45	11
50	30	9.374711	10.625289	9.387261	10.612739	10.012551	9.987449	30	10
51	45	9.374840	10.625160	9.387398	10.612602	10.012558	9.987442	15	9
52	43	9.374970	10.625030	9.387536	10.612464	10.012566	9.987434	17	8
53	15	9.375099	10.624901	9.387673	10.612327	10.012574	9.987426	45	7
54	30	9.375228	10.624772	9.387810	10.612190	10.012582	9.987418	30	6
55	45	9.375358	10.624642	9.387947	10.612053	10.012589	9.987411	15	5
56	44	9.375487	10.624513	9.388084	10.611916	10.012597	9.987403	16	4
57	15	9.375616	10.624384	9.388221	10.611779	10.012605	9.987395	45	3
58	30	9.375745	10.624255	9.388357	10.611643	10.012612	9.987388	30	2
59	45	9.375874	10.624126	9.388494	10.611506	10.012620	9.987380	15	1
60	45	9.376003	10.623997	9.388631	10.611369	10.012628	9.987372	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 54 ^m .		LOG. SINES, &c.						76 deg	

0 ^h 55 ^m .		LOG. SINES, &c. (t)						13 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.376003	10.623997	9.388631	10.611369	10.012628	9.987372	15	60
1	15	9.376132	10.623868	9.388768	10.611232	10.012636	9.987364	45	59
2	30	9.376261	10.623739	9.388905	10.611095	10.012643	9.987357	30	58
3	45	9.376390	10.623610	9.389041	10.610959	10.012651	9.987349	15	57
4	46	9.376519	10.623481	9.389178	10.610822	10.012659	9.987341	14	56
5	15	9.376648	10.623352	9.389315	10.610685	10.012667	9.987333	45	55
6	30	9.376777	10.623223	9.389451	10.610549	10.012674	9.987326	30	54
7	45	9.376906	10.623094	9.389588	10.610412	10.012682	9.987318	15	53
8	47	9.377035	10.622965	9.389724	10.610276	10.012690	9.987310	13	52
9	15	9.377163	10.622837	9.389861	10.610139	10.012698	9.987302	45	51
10	30	9.377292	10.622708	9.389997	10.610003	10.012705	9.987295	30	50
11	45	9.377421	10.622579	9.390134	10.609866	10.012713	9.987287	15	49
12	48	9.377549	10.622451	9.390270	10.609730	10.012721	9.987279	12	48
13	15	9.377678	10.622322	9.390406	10.609594	10.012729	9.987271	45	47
14	30	9.377806	10.622194	9.390543	10.609457	10.012736	9.987264	30	46
15	45	9.377935	10.622065	9.390679	10.609321	10.012744	9.987256	15	45
16	49	9.378063	10.621937	9.390815	10.609185	10.012752	9.987248	11	44
17	15	9.378192	10.621808	9.390951	10.609049	10.012760	9.987240	45	43
18	30	9.378320	10.621680	9.391087	10.608913	10.012767	9.987232	30	42
19	45	9.378448	10.621552	9.391223	10.608777	10.012775	9.987225	15	41
20	50	9.378577	10.621423	9.391359	10.608641	10.012783	9.987217	10	40
21	15	9.378705	10.621295	9.391495	10.608505	10.012791	9.987209	45	39
22	30	9.378833	10.621167	9.391631	10.608369	10.012798	9.987202	30	38
23	45	9.378961	10.621039	9.391767	10.608233	10.012806	9.987194	15	37
24	51	9.379089	10.620911	9.391903	10.608097	10.012814	9.987186	9	36
25	15	9.379217	10.620783	9.392039	10.607961	10.012822	9.987178	45	35
26	30	9.379345	10.620655	9.392175	10.607825	10.012830	9.987170	30	34
27	45	9.379473	10.620527	9.392311	10.607689	10.012837	9.987163	15	33
28	52	9.379601	10.620399	9.392447	10.607553	10.012845	9.987155	8	32
29	15	9.379729	10.620271	9.392582	10.607418	10.012853	9.987147	45	31
30	30	9.379857	10.620143	9.392718	10.607282	10.012861	9.987139	30	30
31	45	9.379985	10.620015	9.392854	10.607146	10.012869	9.987131	15	29
32	53	9.380113	10.619887	9.392989	10.607011	10.012876	9.987124	7	28
33	15	9.380241	10.619759	9.393125	10.606875	10.012884	9.987116	45	27
34	30	9.380368	10.619632	9.393260	10.606740	10.012892	9.987108	30	26
35	45	9.380496	10.619504	9.393396	10.606604	10.012900	9.987100	15	25
36	54	9.380624	10.619376	9.393531	10.606469	10.012908	9.987092	6	24
37	15	9.380751	10.619249	9.393667	10.606333	10.012915	9.987085	45	23
38	30	9.380879	10.619121	9.393802	10.606198	10.012923	9.987077	30	22
39	45	9.381006	10.618994	9.393937	10.606063	10.012931	9.987069	15	21
40	55	9.381134	10.618866	9.394073	10.605927	10.012939	9.987061	5	20
41	15	9.381261	10.618739	9.394208	10.605792	10.012947	9.987053	45	19
42	30	9.381389	10.618611	9.394343	10.605657	10.012955	9.987045	30	18
43	45	9.381516	10.618484	9.394478	10.605522	10.012962	9.987038	15	17
44	56	9.381643	10.618357	9.394614	10.605386	10.012970	9.987030	4	16
45	15	9.381771	10.618229	9.394749	10.605251	10.012978	9.987022	45	15
46	30	9.381898	10.618102	9.394884	10.605116	10.012986	9.987014	30	14
47	45	9.382025	10.617975	9.395019	10.604981	10.012994	9.987006	15	13
48	57	9.382152	10.617848	9.395154	10.604846	10.013002	9.986998	3	12
49	15	9.382279	10.617721	9.395289	10.604711	10.013009	9.986991	45	11
50	30	9.382406	10.617594	9.395424	10.604576	10.013017	9.986983	30	10
51	45	9.382533	10.617467	9.395559	10.604441	10.013025	9.986975	15	9
52	58	9.382660	10.617340	9.395693	10.604307	10.013033	9.986967	2	8
53	15	9.382787	10.617213	9.395828	10.604172	10.013041	9.986959	45	7
54	30	9.382914	10.617086	9.395963	10.604037	10.013049	9.986951	30	6
55	45	9.383041	10.616959	9.396098	10.603902	10.013057	9.986943	15	5
56	59	9.383168	10.616832	9.396233	10.603767	10.013064	9.986936	1	4
57	15	9.383295	10.616705	9.396367	10.603633	10.013072	9.986928	45	3
58	30	9.383422	10.616578	9.396502	10.603498	10.013080	9.986920	30	2
59	45	9.383548	10.616452	9.396636	10.603364	10.013088	9.986912	15	1
60	60	9.383675	10.616325	9.396771	10.603229	10.013096	9.986904	0	0
sec.	"	cosine.	secant.	cotangent	tangent.	coscant.	sine.	"	sec.
5 ^h 4 ^m .		LOG. SINES, &c.						76 deg.	

0 ^h 56 ^m .			LOG. SINES, &c. (t.)				14 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.383675	10.616325	9.396771	10.603229	10.013096	9.986904	60	60
1	15	9.383802	10.616198	9.396906	10.603094	10.013104	9.986896	45	59
2	30	9.383928	10.616072	9.397040	10.602960	10.013112	9.986888	30	58
3	45	9.384055	10.615945	9.397174	10.602826	10.013120	9.986880	15	57
4	1	9.384181	10.615819	9.397309	10.602691	10.013127	9.986873	59	56
5	15	9.384308	10.615692	9.397443	10.602557	10.013135	9.986865	45	55
6	30	9.384434	10.615566	9.397578	10.602422	10.013143	9.986857	30	54
7	45	9.384561	10.615439	9.397712	10.602288	10.013151	9.986849	15	53
8	2	9.384687	10.615313	9.397846	10.602154	10.013159	9.986841	58	52
9	15	9.384814	10.615186	9.397980	10.602020	10.013167	9.986833	45	51
10	30	9.384940	10.615060	9.398115	10.601885	10.013175	9.986825	30	50
11	45	9.385066	10.614934	9.398249	10.601751	10.013183	9.986817	15	49
12	3	9.385192	10.614808	9.398383	10.601617	10.013191	9.986809	57	48
13	15	9.385319	10.614681	9.398517	10.601483	10.013199	9.986801	45	47
14	30	9.385445	10.614555	9.398651	10.601349	10.013206	9.986794	30	46
15	45	9.385571	10.614429	9.398785	10.601215	10.013214	9.986786	15	45
16	4	9.385697	10.614303	9.398919	10.601081	10.013222	9.986778	56	44
17	15	9.385823	10.614177	9.399053	10.600947	10.013230	9.986770	45	43
18	30	9.385949	10.614051	9.399187	10.600813	10.013238	9.986762	30	42
19	45	9.386075	10.613925	9.399321	10.600679	10.013246	9.986754	15	41
20	5	9.386201	10.613799	9.399455	10.600545	10.013254	9.986746	55	40
21	15	9.386327	10.613673	9.399588	10.600412	10.013262	9.986738	45	39
22	30	9.386452	10.613548	9.399722	10.600278	10.013270	9.986730	30	38
23	45	9.386578	10.613422	9.399856	10.600144	10.013278	9.986722	15	37
24	6	9.386704	10.613296	9.399990	10.600010	10.013286	9.986714	54	36
25	15	9.386830	10.613170	9.400123	10.599877	10.013294	9.986706	45	35
26	30	9.386955	10.613045	9.400257	10.599743	10.013301	9.986699	30	34
27	45	9.387081	10.612919	9.400390	10.599610	10.013309	9.986691	15	33
28	7	9.387207	10.612793	9.400524	10.599476	10.013317	9.986683	53	32
29	15	9.387332	10.612668	9.400657	10.599343	10.013325	9.986675	45	31
30	30	9.387458	10.612542	9.400791	10.599209	10.013333	9.986667	30	30
31	45	9.387583	10.612417	9.400924	10.599076	10.013341	9.986659	15	29
32	8	9.387709	10.612291	9.401058	10.598942	10.013349	9.986651	52	28
33	15	9.387834	10.612166	9.401191	10.598809	10.013357	9.986643	45	27
34	30	9.387959	10.612041	9.401324	10.598676	10.013365	9.986635	30	26
35	45	9.388085	10.611915	9.401458	10.598542	10.013373	9.986627	15	25
36	9	9.388210	10.611790	9.401591	10.598409	10.013381	9.986619	51	24
37	15	9.388335	10.611665	9.401724	10.598276	10.013389	9.986611	45	23
38	30	9.388461	10.611539	9.401857	10.598143	10.013397	9.986603	30	22
39	45	9.388586	10.611414	9.401991	10.598009	10.013405	9.986595	15	21
40	10	9.388711	10.611289	9.402124	10.597876	10.013413	9.986587	50	20
41	15	9.388836	10.611164	9.402257	10.597743	10.013421	9.986579	45	19
42	30	9.388961	10.611039	9.402390	10.597610	10.013429	9.986571	30	18
43	45	9.389086	10.610914	9.402523	10.597477	10.013437	9.986563	15	17
44	11	9.389211	10.610789	9.402656	10.597344	10.013445	9.986555	49	16
45	15	9.389336	10.610664	9.402789	10.597211	10.013453	9.986547	45	15
46	30	9.389461	10.610539	9.402922	10.597078	10.013461	9.986539	30	14
47	45	9.389586	10.610414	9.403054	10.596946	10.013469	9.986531	15	13
48	12	9.389711	10.610289	9.403187	10.596813	10.013477	9.986523	48	12
49	15	9.389835	10.610165	9.403320	10.596680	10.013485	9.986515	45	11
50	30	9.389960	10.610040	9.403453	10.596547	10.013493	9.986507	30	10
51	45	9.390085	10.609915	9.403585	10.596415	10.013501	9.986499	15	9
52	13	9.390210	10.609790	9.403718	10.596282	10.013509	9.986491	47	8
53	15	9.390334	10.609666	9.403851	10.596149	10.013517	9.986483	45	7
54	30	9.390459	10.609541	9.403983	10.596017	10.013525	9.986475	30	6
55	45	9.390583	10.609417	9.404116	10.595884	10.013533	9.986467	15	5
56	14	9.390708	10.609292	9.404249	10.595751	10.013541	9.986459	46	4
57	15	9.390832	10.609168	9.404381	10.595619	10.013549	9.986451	45	3
58	30	9.390957	10.609043	9.404514	10.595486	10.013557	9.986443	30	2
59	45	9.391081	10.608919	9.404646	10.595354	10.013565	9.986435	15	1
60	15	9.391206	10.608794	9.404778	10.595222	10.013573	9.986427	45	0
sec.	"	cosine.	secant.	cotangent	tangent.	cosecant.	sine.	"	sec.
5 ^h 3 ^m .			LOG. SINES, &c.				75 deg.		

0 ^h 57 ^m .		LOG. SINES, &c. (t.)						14 deg.		
deg.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.			sec.
0	15	9.391206	10.608794	9.404778	10.595222	10.013573	9.986427	45		60
1	15	9.391330	10.608670	9.404911	10.595089	10.013581	9.986419	45		59
2	30	9.391454	10.608546	9.405043	10.594957	10.013589	9.986411	30		58
3	45	9.391579	10.608421	9.405175	10.594825	10.013597	9.986403	15		57
4	16	9.391703	10.608297	9.405308	10.594692	10.013605	9.986395	44		56
5	15	9.391827	10.608173	9.405440	10.594560	10.013613	9.986387	45		55
6	30	9.391951	10.608049	9.405572	10.594428	10.013621	9.986379	30		54
7	45	9.392075	10.607925	9.405704	10.594296	10.013629	9.986371	15		53
8	17	9.392199	10.607801	9.405836	10.594164	10.013637	9.986363	43		52
9	15	9.392323	10.607677	9.405968	10.594032	10.013645	9.986355	45		51
10	30	9.392447	10.607553	9.406100	10.593900	10.013653	9.986347	30		50
11	45	9.392571	10.607429	9.406232	10.593768	10.013661	9.986339	15		49
12	18	9.392695	10.607305	9.406364	10.593636	10.013669	9.986331	42		48
13	15	9.392819	10.607181	9.406496	10.593504	10.013677	9.986323	45		47
14	30	9.392943	10.607057	9.406628	10.593372	10.013685	9.986315	30		46
15	45	9.393067	10.606933	9.406760	10.593240	10.013693	9.986307	15		45
16	19	9.393190	10.606810	9.406892	10.593108	10.013701	9.986299	41		44
17	15	9.393314	10.606686	9.407024	10.592976	10.013710	9.986290	45		43
18	30	9.393438	10.606562	9.407155	10.592845	10.013718	9.986282	30		42
19	45	9.393562	10.606438	9.407287	10.592713	10.013726	9.986274	15		41
20	20	9.393685	10.606315	9.407419	10.592581	10.013734	9.986266	40		40
21	15	9.393809	10.606191	9.407551	10.592449	10.013742	9.986258	45		39
22	30	9.393932	10.606068	9.407682	10.592318	10.013750	9.986250	30		38
23	45	9.394056	10.605944	9.407814	10.592186	10.013758	9.986242	15		37
24	21	9.394179	10.605821	9.407945	10.592055	10.013766	9.986234	39		36
25	15	9.394303	10.605697	9.408077	10.591923	10.013774	9.986226	45		35
26	30	9.394426	10.605574	9.408208	10.591792	10.013782	9.986218	30		34
27	45	9.394550	10.605450	9.408340	10.591660	10.013790	9.986210	15		33
28	22	9.394673	10.605327	9.408471	10.591529	10.013798	9.986202	38		32
29	15	9.394796	10.605204	9.408602	10.591398	10.013806	9.986194	45		31
30	30	9.394919	10.605081	9.408734	10.591266	10.013815	9.986185	30		30
31	45	9.395043	10.604957	9.408865	10.591135	10.013823	9.986177	15		29
32	23	9.395166	10.604834	9.408996	10.591004	10.013831	9.986169	37		28
33	15	9.395289	10.604711	9.409128	10.590872	10.013839	9.986161	45		27
34	30	9.395412	10.604588	9.409259	10.590741	10.013847	9.986153	30		26
35	45	9.395535	10.604465	9.409390	10.590610	10.013855	9.986145	15		25
36	24	9.395658	10.604342	9.409521	10.590479	10.013863	9.986137	36		24
37	15	9.395781	10.604219	9.409652	10.590348	10.013871	9.986129	45		23
38	30	9.395904	10.604096	9.409783	10.590217	10.013879	9.986121	30		22
39	45	9.396027	10.603973	9.409914	10.590086	10.013887	9.986113	15		21
40	25	9.396150	10.603850	9.410045	10.589955	10.013896	9.986104	35		20
41	15	9.396273	10.603727	9.410176	10.589824	10.013904	9.986096	45		19
42	30	9.396395	10.603605	9.410307	10.589693	10.013912	9.986088	30		18
43	45	9.396518	10.603482	9.410438	10.589562	10.013920	9.986080	15		17
44	26	9.396641	10.603359	9.410569	10.589431	10.013928	9.986072	34		16
45	15	9.396764	10.603236	9.410700	10.589300	10.013936	9.986064	45		15
46	30	9.396886	10.603114	9.410831	10.589169	10.013944	9.986056	30		14
47	45	9.397009	10.602991	9.410961	10.589039	10.013952	9.986048	15		13
48	27	9.397131	10.602869	9.411092	10.588908	10.013961	9.986039	33		12
49	15	9.397254	10.602746	9.411223	10.588777	10.013969	9.986031	45		11
50	30	9.397377	10.602623	9.411353	10.588647	10.013977	9.986023	30		10
51	45	9.397499	10.602501	9.411484	10.588516	10.013985	9.986015	15		9
52	28	9.397621	10.602379	9.411615	10.588385	10.013993	9.986007	32		8
53	15	9.397744	10.602256	9.411745	10.588255	10.014001	9.985999	45		7
54	30	9.397866	10.602134	9.411876	10.588124	10.014009	9.985991	30		6
55	45	9.397989	10.602011	9.412006	10.587994	10.014018	9.985982	15		5
56	29	9.398111	10.601889	9.412137	10.587863	10.014026	9.985974	31		4
57	15	9.398233	10.601767	9.412267	10.587733	10.014034	9.985966	45		3
58	30	9.398355	10.601645	9.412397	10.587603	10.014042	9.985958	30		2
59	45	9.398477	10.601523	9.412528	10.587472	10.014050	9.985950	15		1
60	30	9.398600	10.601400	9.412658	10.587342	10.014058	9.985942	30		0
sec.		cosine.	secant.	cotangent.	tangent.	cosecant.	sine.			sec.
5 ^h 2 ^m .		LOG. SINES, &c.						75 deg.		

0 ^h 58 ^m .			LOG. SINES, &c. (t.)				14 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	30	9.398600	10.601400	9.412658	10.587342	10.014058	9.985942	30		60
1	15	9.398722	10.601278	9.412788	10.587212	10.014067	9.985933	45		59
2	30	9.398844	10.601156	9.412919	10.587081	10.014075	9.985925	30		58
3	45	9.398966	10.601034	9.413049	10.586951	10.014083	9.985917	15		57
4	31	9.399088	10.600912	9.413179	10.586821	10.014091	9.985909	29		56
5	15	9.399210	10.600790	9.413309	10.586691	10.014099	9.985901	45		55
6	30	9.399332	10.600668	9.413439	10.586561	10.014108	9.985892	30		54
7	45	9.399454	10.600546	9.413569	10.586431	10.014116	9.985884	15		53
8	32	9.399575	10.600425	9.413699	10.586301	10.014124	9.985876	28		52
9	15	9.399697	10.600303	9.413829	10.586171	10.014132	9.985868	45		51
10	30	9.399819	10.600181	9.413959	10.586041	10.014140	9.985860	30		50
11	45	9.399941	10.600059	9.414089	10.585911	10.014148	9.985852	15		49
12	33	9.400062	10.599938	9.414219	10.585781	10.014157	9.985843	27		48
13	15	9.400184	10.599816	9.414349	10.585651	10.014165	9.985835	45		47
14	30	9.400306	10.599694	9.414479	10.585521	10.014173	9.985827	30		46
15	45	9.400427	10.599573	9.414609	10.585391	10.014181	9.985819	15		45
16	34	9.400549	10.599451	9.414738	10.585262	10.014189	9.985811	26		44
17	15	9.400670	10.599330	9.414868	10.585132	10.014198	9.985802	45		43
18	30	9.400792	10.599208	9.414998	10.585002	10.014206	9.985794	30		42
19	45	9.400913	10.599087	9.415127	10.584873	10.014214	9.985786	15		41
20	35	9.401035	10.598965	9.415257	10.584743	10.014222	9.985778	25		40
21	15	9.401156	10.598844	9.415387	10.584613	10.014231	9.985769	45		39
22	30	9.401277	10.598723	9.415516	10.584484	10.014239	9.985761	30		38
23	45	9.401399	10.598601	9.415646	10.584354	10.014247	9.985753	15		37
24	36	9.401520	10.598480	9.415775	10.584225	10.014255	9.985745	24		36
25	15	9.401641	10.598359	9.415905	10.584095	10.014263	9.985737	45		35
26	30	9.401762	10.598238	9.416034	10.583966	10.014272	9.985728	30		34
27	45	9.401884	10.598116	9.416163	10.583837	10.014280	9.985720	15		33
28	37	9.402005	10.597995	9.416293	10.583707	10.014288	9.985712	23		32
29	15	9.402126	10.597874	9.416422	10.583578	10.014296	9.985704	45		31
30	30	9.402247	10.597753	9.416551	10.583449	10.014305	9.985695	30		30
31	45	9.402368	10.597632	9.416681	10.583319	10.014313	9.985687	15		29
32	38	9.402489	10.597511	9.416810	10.583190	10.014321	9.985679	22		28
33	15	9.402610	10.597390	9.416939	10.583061	10.014329	9.985671	45		27
34	30	9.402731	10.597269	9.417068	10.582932	10.014338	9.985662	30		26
35	45	9.402852	10.597148	9.417197	10.582803	10.014346	9.985654	15		25
36	39	9.402972	10.597028	9.417326	10.582674	10.014354	9.985646	21		24
37	15	9.403093	10.596907	9.417455	10.582545	10.014362	9.985638	45		23
38	30	9.403214	10.596786	9.417585	10.582415	10.014371	9.985629	30		22
39	45	9.403335	10.596665	9.417713	10.582287	10.014379	9.985621	15		21
40	40	9.403455	10.596545	9.417842	10.582158	10.014387	9.985613	20		20
41	15	9.403576	10.596424	9.417971	10.582029	10.014395	9.985605	45		19
42	30	9.403697	10.596303	9.418100	10.581900	10.014404	9.985596	30		18
43	45	9.403817	10.596183	9.418229	10.581771	10.014412	9.985588	15		17
44	41	9.403938	10.596062	9.418358	10.581642	10.014420	9.985580	19		16
45	15	9.404058	10.595942	9.418487	10.581513	10.014428	9.985572	45		15
46	30	9.404179	10.595821	9.418615	10.581385	10.014437	9.985563	30		14
47	45	9.404299	10.595701	9.418744	10.581256	10.014445	9.985555	15		13
48	42	9.404420	10.595580	9.418873	10.581127	10.014453	9.985547	18		12
49	15	9.404540	10.595460	9.419002	10.580998	10.014462	9.985538	45		11
50	30	9.404660	10.595340	9.419130	10.580870	10.014470	9.985530	30		10
51	45	9.404781	10.595219	9.419259	10.580741	10.014478	9.985522	15		9
52	43	9.404901	10.595099	9.419387	10.580613	10.014487	9.985513	17		8
53	15	9.405021	10.594979	9.419516	10.580484	10.014495	9.985505	45		7
54	30	9.405141	10.594859	9.419644	10.580356	10.014503	9.985497	30		6
55	45	9.405261	10.594739	9.419773	10.580227	10.014511	9.985489	15		5
56	44	9.405382	10.594618	9.419901	10.580099	10.014520	9.985480	16		4
57	15	9.405502	10.594498	9.420030	10.579970	10.014528	9.985472	45		3
58	30	9.405622	10.594378	9.420158	10.579842	10.014536	9.985464	30		2
59	45	9.405742	10.594258	9.420286	10.579714	10.014545	9.985455	15		1
60	45	9.405862	10.594138	9.420415	10.579585	10.014553	9.985447	15		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
5 ^h 1 ^m .			LOG. SINES, &c.				75 deg.			

0 ^h 59 ^m .		LOG. SINES, &c. (t.)						14 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.405862	10.594138	9.420415	10.579585	10.014553	9.985447	15	60
1	15	9.405982	10.594018	9.420543	10.579457	10.014561	9.985439	45	59
2	30	9.406102	10.593898	9.420671	10.579329	10.014570	9.985430	30	58
3	45	9.406221	10.593779	9.420799	10.579201	10.014578	9.985422	15	57
4	46	9.406341	10.593659	9.420927	10.579073	10.014586	9.985414	14	56
5	15	9.406461	10.593539	9.421056	10.578944	10.014595	9.985405	45	55
6	30	9.406581	10.593419	9.421184	10.578816	10.014603	9.985397	30	54
7	45	9.406701	10.593299	9.421312	10.578688	10.014611	9.985389	15	53
8	47	9.406820	10.593180	9.421440	10.578560	10.014620	9.985380	13	52
9	15	9.406940	10.593060	9.421568	10.578432	10.014628	9.985372	45	51
10	30	9.407060	10.592940	9.421696	10.578304	10.014636	9.985364	30	50
11	45	9.407179	10.592821	9.421824	10.578176	10.014645	9.985355	15	49
12	48	9.407299	10.592701	9.421951	10.578049	10.014653	9.985347	12	48
13	15	9.407418	10.592582	9.422079	10.577921	10.014661	9.985339	45	47
14	30	9.407538	10.592462	9.422207	10.577793	10.014670	9.985330	30	46
15	45	9.407657	10.592343	9.422335	10.577665	10.014678	9.985322	15	45
16	49	9.407777	10.592223	9.422463	10.577537	10.014686	9.985314	11	44
17	15	9.407896	10.592104	9.422590	10.577410	10.014695	9.985305	45	43
18	30	9.408015	10.591985	9.422718	10.577282	10.014703	9.985297	30	42
19	45	9.408135	10.591865	9.422846	10.577154	10.014711	9.985289	15	41
20	50	9.408254	10.591746	9.422973	10.577027	10.014720	9.985280	10	40
21	15	9.408373	10.591627	9.423101	10.576899	10.014728	9.985272	45	39
22	30	9.408492	10.591508	9.423229	10.576771	10.014736	9.985264	30	38
23	45	9.408611	10.591389	9.423356	10.576644	10.014745	9.985255	15	37
24	51	9.408731	10.591269	9.423484	10.576516	10.014753	9.985247	9	36
25	15	9.408850	10.591150	9.423611	10.576389	10.014762	9.985238	45	35
26	30	9.408969	10.591031	9.423739	10.576261	10.014770	9.985230	30	34
27	45	9.409088	10.590912	9.423866	10.576134	10.014778	9.985222	15	33
28	52	9.409207	10.590793	9.423993	10.576007	10.014787	9.985213	8	32
29	15	9.409326	10.590674	9.424121	10.575879	10.014795	9.985205	45	31
30	30	9.409445	10.590555	9.424248	10.575752	10.014804	9.985196	30	30
31	45	9.409563	10.590437	9.424375	10.575625	10.014812	9.985188	15	29
32	53	9.409682	10.590318	9.424503	10.575497	10.014820	9.985180	7	28
33	15	9.409801	10.590199	9.424630	10.575370	10.014829	9.985171	45	27
34	30	9.409920	10.590080	9.424757	10.575243	10.014837	9.985163	30	26
35	45	9.410039	10.589961	9.424884	10.575116	10.014845	9.985155	15	25
36	54	9.410157	10.589843	9.425011	10.574989	10.014854	9.985146	6	24
37	15	9.410276	10.589724	9.425138	10.574862	10.014862	9.985138	45	23
38	30	9.410395	10.589605	9.425265	10.574735	10.014871	9.985129	30	22
39	45	9.410513	10.589487	9.425392	10.574608	10.014879	9.985121	15	21
40	55	9.410632	10.589368	9.425519	10.574481	10.014888	9.985112	5	20
41	15	9.410750	10.589250	9.425646	10.574354	10.014896	9.985104	45	19
42	30	9.410869	10.589131	9.425773	10.574227	10.014904	9.985096	30	18
43	45	9.410987	10.589013	9.425900	10.574100	10.014913	9.985087	15	17
44	56	9.411106	10.588894	9.426027	10.573973	10.014921	9.985079	4	16
45	15	9.411224	10.588776	9.426154	10.573846	10.014930	9.985070	45	15
46	30	9.411343	10.588657	9.426281	10.573719	10.014938	9.985062	30	14
47	45	9.411461	10.588539	9.426407	10.573593	10.014946	9.985054	15	13
48	57	9.411579	10.588421	9.426534	10.573466	10.014955	9.985045	3	12
49	15	9.411698	10.588302	9.426661	10.573339	10.014963	9.985037	45	11
50	30	9.411816	10.588184	9.426787	10.573213	10.014972	9.985028	30	10
51	45	9.411934	10.588066	9.426914	10.573086	10.014980	9.985020	15	9
52	58	9.412052	10.587948	9.427041	10.572959	10.014989	9.985011	2	8
53	15	9.412170	10.587830	9.427167	10.572833	10.014997	9.985003	45	7
54	30	9.412288	10.587712	9.427294	10.572706	10.015006	9.984994	30	6
55	45	9.412406	10.587594	9.427420	10.572580	10.015014	9.984986	15	5
56	59	9.412524	10.587476	9.427547	10.572453	10.015022	9.984978	1	4
57	15	9.412642	10.587358	9.427673	10.572327	10.015031	9.984969	45	3
58	30	9.412760	10.587240	9.427800	10.572200	10.015039	9.984961	30	2
59	45	9.412878	10.587122	9.427926	10.572074	10.015048	9.984952	15	1
60	60	9.412996	10.587004	9.428052	10.571948	10.015056	9.984944	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
5 ^h 0 ^m .		LOG. SINES, &c.						75 deg.	

1 ^h 0 ^m .		LOG. SINES, &c. (t.)						15 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.412996	10.587004	9.428052	10.571948	10.015056	9.984944	60	60
1	15	9.413114	10.586886	9.428179	10.571821	10.015065	9.984935	45	59
2	30	9.413232	10.586768	9.428305	10.571695	10.015073	9.984927	30	58
3	45	9.413350	10.586650	9.428431	10.571569	10.015082	9.984918	15	57
4	1	9.413467	10.586533	9.428557	10.571443	10.015090	9.984910	59	56
5	15	9.413585	10.586415	9.428684	10.571316	10.015099	9.984901	45	55
6	30	9.413703	10.586297	9.428810	10.571190	10.015107	9.984893	30	54
7	45	9.413821	10.586179	9.428936	10.571064	10.015116	9.984884	15	53
8	2	9.413938	10.586062	9.429062	10.570938	10.015124	9.984876	58	52
9	15	9.414056	10.585944	9.429188	10.570812	10.015133	9.984867	45	51
10	30	9.414173	10.585827	9.429314	10.570686	10.015141	9.984859	30	50
11	45	9.414291	10.585709	9.429440	10.570560	10.015150	9.984850	15	49
12	3	9.414408	10.585592	9.429566	10.570434	10.015158	9.984842	57	48
13	15	9.414526	10.585474	9.429692	10.570308	10.015166	9.984834	45	47
14	30	9.414643	10.585357	9.429818	10.570182	10.015175	9.984825	30	46
15	45	9.414760	10.585240	9.429944	10.570056	10.015183	9.984817	15	45
16	4	9.414878	10.585122	9.430070	10.569930	10.015192	9.984808	56	44
17	15	9.414995	10.585005	9.430195	10.569805	10.015200	9.984800	45	43
18	30	9.415112	10.584888	9.430321	10.569679	10.015209	9.984791	30	42
19	45	9.415230	10.584770	9.430447	10.569553	10.015218	9.984782	15	41
20	5	9.415347	10.584653	9.430573	10.569427	10.015226	9.984774	55	40
21	15	9.415464	10.584536	9.430698	10.569302	10.015235	9.984765	45	39
22	30	9.415581	10.584419	9.430824	10.569176	10.015243	9.984757	30	38
23	45	9.415698	10.584302	9.430950	10.569050	10.015252	9.984748	15	37
24	6	9.415815	10.584185	9.431075	10.568925	10.015260	9.984740	54	36
25	15	9.415932	10.584068	9.431201	10.568799	10.015269	9.984731	45	35
26	30	9.416049	10.583951	9.431326	10.568674	10.015277	9.984723	30	34
27	45	9.416166	10.583834	9.431452	10.568548	10.015286	9.984714	15	33
28	7	9.416283	10.583717	9.431577	10.568423	10.015294	9.984706	53	32
29	15	9.416400	10.583600	9.431703	10.568297	10.015303	9.984697	45	31
30	30	9.416517	10.583483	9.431828	10.568172	10.015311	9.984689	30	30
31	45	9.416634	10.583366	9.431953	10.568047	10.015320	9.984680	15	29
32	8	9.416751	10.583249	9.432079	10.567921	10.015328	9.984672	52	28
33	15	9.416867	10.583133	9.432204	10.567796	10.015337	9.984663	45	27
34	30	9.416984	10.583016	9.432329	10.567671	10.015345	9.984655	30	26
35	45	9.417101	10.582899	9.432455	10.567545	10.015354	9.984646	15	25
36	9	9.417217	10.582783	9.432580	10.567420	10.015363	9.984637	51	24
37	15	9.417334	10.582666	9.432705	10.567295	10.015371	9.984629	45	23
38	30	9.417451	10.582549	9.432830	10.567170	10.015380	9.984620	30	22
39	45	9.417567	10.582433	9.432955	10.567045	10.015388	9.984612	15	21
40	10	9.417684	10.582316	9.433080	10.566920	10.015397	9.984603	50	20
41	15	9.417800	10.582200	9.433205	10.566795	10.015405	9.984595	45	19
42	30	9.417917	10.582083	9.433330	10.566670	10.015414	9.984586	30	18
43	45	9.418033	10.581967	9.433455	10.566545	10.015422	9.984578	15	17
44	11	9.418149	10.581851	9.433580	10.566420	10.015431	9.984569	49	16
45	15	9.418266	10.581734	9.433705	10.566295	10.015440	9.984560	45	15
46	30	9.418382	10.581618	9.433830	10.566170	10.015448	9.984552	30	14
47	45	9.418498	10.581502	9.433955	10.566045	10.015457	9.984543	15	13
48	12	9.418615	10.581385	9.434080	10.565920	10.015465	9.984535	48	12
49	15	9.418731	10.581269	9.434205	10.565795	10.015474	9.984526	45	11
50	30	9.418847	10.581153	9.434330	10.565670	10.015482	9.984518	30	10
51	45	9.418963	10.581037	9.434454	10.565546	10.015491	9.984509	15	9
52	13	9.419079	10.580921	9.434579	10.565421	10.015500	9.984500	47	8
53	15	9.419196	10.580804	9.434704	10.565296	10.015508	9.984492	45	7
54	30	9.419312	10.580688	9.434828	10.565172	10.015517	9.984483	30	6
55	45	9.419428	10.580572	9.434953	10.565047	10.015525	9.984475	15	5
56	14	9.419544	10.580456	9.435078	10.564922	10.015534	9.984466	46	4
57	15	9.419660	10.580340	9.435202	10.564798	10.015543	9.984457	45	3
58	30	9.419775	10.580225	9.435327	10.564673	10.015551	9.984449	30	2
59	45	9.419891	10.580109	9.435451	10.564549	10.015560	9.984440	15	1
60	15	9.420007	10.579993	9.435576	10.564424	10.015568	9.984432	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

4^h 59^m.

LOG. SINES, &c.

74 deg.

1 ^h 1 ^m .		LOG. SINES, &c. (t)						15 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	15	9.420007	10.579993	9.435576	10.564424	10.015508	9.984432	45		60
1	15	9.420123	10.579877	9.435700	10.564300	10.015577	9.984423	45		59
2	30	9.420239	10.579761	9.435824	10.564176	10.015586	9.984414	30		58
3	45	9.420355	10.579645	9.435949	10.564051	10.015594	9.984406	15		57
4	16	9.420470	10.579530	9.436073	10.563927	10.015603	9.984397	44		56
5	15	9.420586	10.579414	9.436198	10.563802	10.015612	9.984388	45		55
6	30	9.420702	10.579298	9.436322	10.563678	10.015620	9.984380	30		54
7	45	9.420817	10.579183	9.436446	10.563553	10.015629	9.984371	15		53
8	17	9.420933	10.579067	9.436570	10.563430	10.015637	9.984363	43		52
9	15	9.421048	10.578952	9.436695	10.563305	10.015646	9.984354	45		51
10	30	9.421164	10.578836	9.436819	10.563181	10.015655	9.984345	30		50
11	45	9.421280	10.578720	9.436943	10.563057	10.015663	9.984337	15		49
12	18	9.421395	10.578605	9.437067	10.562933	10.015672	9.984328	42		48
13	15	9.421510	10.578490	9.437191	10.562809	10.015681	9.984319	45		47
14	30	9.421626	10.578374	9.437315	10.562685	10.015689	9.984311	30		46
15	45	9.421741	10.578259	9.437439	10.562561	10.015698	9.984302	15		45
16	19	9.421857	10.578143	9.437563	10.562437	10.015707	9.984293	41		44
17	15	9.421972	10.578028	9.437687	10.562313	10.015715	9.984285	45		43
18	30	9.422087	10.577913	9.437811	10.562189	10.015724	9.984276	30		42
19	45	9.422202	10.577798	9.437935	10.562065	10.015733	9.984267	15		41
20	20	9.422318	10.577682	9.438059	10.561941	10.015741	9.984259	40		40
21	15	9.422433	10.577567	9.438182	10.561818	10.015750	9.984250	45		39
22	30	9.422548	10.577452	9.438306	10.561694	10.015758	9.984242	30		38
23	45	9.422663	10.577337	9.438430	10.561570	10.015767	9.984233	15		37
24	21	9.422778	10.577222	9.438554	10.561446	10.015776	9.984224	39		36
25	15	9.422893	10.577107	9.438677	10.561323	10.015784	9.984216	45		35
26	30	9.423008	10.576992	9.438801	10.561199	10.015793	9.984207	30		34
27	45	9.423123	10.576877	9.438925	10.561075	10.015802	9.984198	15		33
28	22	9.423238	10.576762	9.439048	10.560952	10.015811	9.984189	38		32
29	15	9.423353	10.576647	9.439172	10.560828	10.015819	9.984181	45		31
30	30	9.423468	10.576532	9.439296	10.560704	10.015828	9.984172	30		30
31	45	9.423583	10.576417	9.439419	10.560581	10.015837	9.984163	15		29
32	23	9.423697	10.576303	9.439543	10.560457	10.015845	9.984155	37		28
33	15	9.423812	10.576188	9.439666	10.560334	10.015854	9.984146	45		27
34	30	9.423927	10.576073	9.439789	10.560211	10.015863	9.984137	30		26
35	45	9.424042	10.575958	9.439913	10.560087	10.015871	9.984129	15		25
36	24	9.424156	10.575844	9.440036	10.559964	10.015880	9.984120	36		24
37	15	9.424271	10.575729	9.440160	10.559840	10.015889	9.984111	45		23
38	30	9.424386	10.575614	9.440283	10.559717	10.015897	9.984103	30		22
39	45	9.424500	10.575500	9.440406	10.559594	10.015906	9.984094	15		21
40	25	9.424615	10.575385	9.440529	10.559471	10.015915	9.984085	35		20
41	15	9.424729	10.575271	9.440653	10.559347	10.015924	9.984076	45		19
42	30	9.424844	10.575156	9.440776	10.559224	10.015932	9.984068	30		18
43	45	9.424958	10.575042	9.440899	10.559101	10.015941	9.984059	15		17
44	26	9.425073	10.574927	9.441022	10.558978	10.015950	9.984050	34		16
45	15	9.425187	10.574813	9.441145	10.558855	10.015958	9.984042	45		15
46	30	9.425301	10.574699	9.441268	10.558732	10.015967	9.984033	30		14
47	45	9.425416	10.574584	9.441391	10.558609	10.015976	9.984024	15		13
48	27	9.425530	10.574470	9.441514	10.558486	10.015985	9.984015	33		12
49	15	9.425644	10.574356	9.441637	10.558363	10.015993	9.984007	45		11
50	30	9.425758	10.574242	9.441760	10.558240	10.016002	9.983998	30		10
51	45	9.425873	10.574127	9.441883	10.558117	10.016011	9.983989	15		9
52	28	9.425987	10.574013	9.442006	10.557994	10.016020	9.983980	32		8
53	15	9.426101	10.573899	9.442129	10.557871	10.016028	9.983972	45		7
54	30	9.426215	10.573785	9.442252	10.557748	10.016037	9.983963	30		6
55	45	9.426329	10.573671	9.442375	10.557625	10.016046	9.983954	15		5
56	29	9.426443	10.573557	9.442497	10.557503	10.016055	9.983945	31		4
57	15	9.426557	10.573443	9.442620	10.557380	10.016063	9.983937	45		3
58	30	9.426671	10.573329	9.442743	10.557257	10.016072	9.983928	30		2
59	45	9.426785	10.573215	9.442866	10.557134	10.016081	9.983919	15		1
60	30	9.426899	10.573101	9.442988	10.557012	10.016090	9.983910	30		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
4 ^h 5 ^m .		LOG. SINES, &c.						74 deg.		

1 ^h 2 ^m .		LOG. SINES, &c. (t.)						15 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.426899	10.573101	9.442988	10.557012	10.016090	9.983910	30	60
1	15	9.427013	10.572987	9.443111	10.556889	10.016098	9.983902	45	59
2	30	9.427126	10.572874	9.443233	10.556767	10.016107	9.983893	30	58
3	45	9.427240	10.572760	9.443356	10.556644	10.016116	9.983884	15	57
4	31	9.427354	10.572646	9.443479	10.556521	10.016125	9.983875	29	56
5	15	9.427468	10.572532	9.443601	10.556399	10.016133	9.983867	45	55
6	30	9.427581	10.572419	9.443724	10.556276	10.016142	9.983858	30	54
7	45	9.427695	10.572305	9.443846	10.556154	10.016151	9.983849	15	53
8	32	9.427809	10.572191	9.443968	10.556032	10.016160	9.983840	28	52
9	15	9.427922	10.572078	9.444091	10.555909	10.016168	9.983832	45	51
10	30	9.428036	10.571964	9.444213	10.555787	10.016177	9.983823	30	50
11	45	9.428150	10.571850	9.444336	10.555664	10.016186	9.983814	15	49
12	33	9.428263	10.571737	9.444458	10.555542	10.016195	9.983805	27	48
13	15	9.428377	10.571623	9.444580	10.555420	10.016204	9.983796	45	47
14	30	9.428490	10.571510	9.444702	10.555298	10.016212	9.983788	30	46
15	45	9.428603	10.571397	9.444825	10.555175	10.016221	9.983779	15	45
16	34	9.428717	10.571283	9.444947	10.555053	10.016230	9.983770	26	44
17	15	9.428830	10.571170	9.445069	10.554931	10.016239	9.983761	45	43
18	30	9.428943	10.571057	9.445191	10.554809	10.016248	9.983752	30	42
19	45	9.429057	10.570943	9.445313	10.554687	10.016256	9.983744	15	41
20	35	9.429170	10.570830	9.445435	10.554565	10.016265	9.983735	25	40
21	15	9.429283	10.570717	9.445557	10.554443	10.016274	9.983726	45	39
22	30	9.429396	10.570604	9.445679	10.554321	10.016283	9.983717	30	38
23	45	9.429510	10.570490	9.445801	10.554199	10.016292	9.983708	15	37
24	36	9.429623	10.570377	9.445923	10.554077	10.016300	9.983700	24	36
25	15	9.429736	10.570264	9.446045	10.553955	10.016309	9.983691	45	35
26	30	9.429849	10.570151	9.446167	10.553833	10.016318	9.983682	30	34
27	45	9.429962	10.570038	9.446289	10.553711	10.016327	9.983673	15	33
28	37	9.430075	10.569925	9.446411	10.553589	10.016336	9.983664	23	32
29	15	9.430188	10.569812	9.446532	10.553468	10.016345	9.983655	45	31
30	30	9.430301	10.569699	9.446654	10.553346	10.016353	9.983647	30	30
31	45	9.430414	10.569586	9.446776	10.553224	10.016362	9.983638	15	29
32	38	9.430527	10.569473	9.446898	10.553102	10.016371	9.983629	22	28
33	15	9.430640	10.569360	9.447019	10.552981	10.016380	9.983620	45	27
34	30	9.430752	10.569248	9.447141	10.552859	10.016389	9.983611	30	26
35	45	9.430865	10.569135	9.447263	10.552737	10.016398	9.983602	15	25
36	39	9.430978	10.569022	9.447384	10.552616	10.016406	9.983594	21	24
37	15	9.431091	10.568909	9.447506	10.552494	10.016415	9.983585	45	23
38	30	9.431203	10.568797	9.447627	10.552373	10.016424	9.983576	30	22
39	45	9.431316	10.568684	9.447749	10.552251	10.016433	9.983567	15	21
40	40	9.431429	10.568571	9.447870	10.552130	10.016442	9.983558	20	20
41	15	9.431541	10.568459	9.447992	10.552008	10.016451	9.983549	45	19
42	30	9.431654	10.568346	9.448113	10.551887	10.016460	9.983540	30	18
43	45	9.431766	10.568234	9.448235	10.551765	10.016468	9.983532	15	17
44	41	9.431879	10.568121	9.448356	10.551644	10.016477	9.983523	19	16
45	15	9.431991	10.568009	9.448477	10.551523	10.016486	9.983514	45	15
46	30	9.432104	10.567896	9.448599	10.551401	10.016495	9.983505	30	14
47	45	9.432216	10.567784	9.448720	10.551280	10.016504	9.983496	15	13
48	42	9.432328	10.567672	9.448841	10.551159	10.016513	9.983487	18	12
49	15	9.432441	10.567559	9.448962	10.551038	10.016522	9.983478	45	11
50	30	9.432553	10.567447	9.449084	10.550916	10.016531	9.983469	30	10
51	45	9.432665	10.567335	9.449205	10.550795	10.016539	9.983461	15	9
52	43	9.432778	10.567222	9.449326	10.550674	10.016548	9.983452	17	8
53	15	9.432890	10.567110	9.449447	10.550553	10.016557	9.983443	45	7
54	30	9.433002	10.566998	9.449568	10.550432	10.016566	9.983434	30	6
55	45	9.433114	10.566886	9.449689	10.550311	10.016575	9.983425	15	5
56	44	9.433226	10.566774	9.449810	10.550190	10.016584	9.983416	16	4
57	15	9.433338	10.566662	9.449931	10.550069	10.016593	9.983407	45	3
58	30	9.433450	10.566550	9.450052	10.549948	10.016602	9.983398	30	2
59	45	9.433563	10.566437	9.450173	10.549827	10.016611	9.983389	15	1
60	45	9.433675	10.566325	9.450294	10.549706	10.016620	9.983380	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 57 ^m .		LOG. SINES, &c.						74 deg	

1 ^h 3 ^m .		LOG. SINES, &c. (t)						15 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	45	9.433675	10.566325	9.450294	10.549706	10.016620	9.983380	15		60
1	15	9.433786	10.566214	9.450415	10.549585	10.016628	9.983372	45		59
2	30	9.433898	10.566102	9.450536	10.549464	10.016637	9.983363	30		58
3	45	9.434010	10.565990	9.450657	10.549343	10.016646	9.983354	15		57
4	46	9.434122	10.565878	9.450777	10.549223	10.016655	9.983345		14	56
5	15	9.434234	10.565766	9.450898	10.549102	10.016664	9.983336	45		55
6	30	9.434346	10.565654	9.451019	10.548981	10.016673	9.983327	30		54
7	45	9.434458	10.565542	9.451140	10.548860	10.016682	9.983318	15		53
8	47	9.434569	10.565431	9.451260	10.548740	10.016691	9.983309		13	52
9	15	9.434681	10.565319	9.451381	10.548619	10.016700	9.983300	45		51
10	30	9.434793	10.565207	9.451501	10.548499	10.016709	9.983291	30		50
11	45	9.434904	10.565096	9.451622	10.548378	10.016718	9.983282	15		49
12	48	9.435016	10.564984	9.451743	10.548257	10.016727	9.983273		12	48
13	15	9.435128	10.564872	9.451863	10.548137	10.016736	9.983264	45		47
14	30	9.435239	10.564761	9.451984	10.548016	10.016744	9.983256	30		46
15	45	9.435351	10.564649	9.452104	10.547896	10.016753	9.983247	15		45
16	49	9.435462	10.564538	9.452225	10.547775	10.016762	9.983238		11	44
17	15	9.435574	10.564426	9.452345	10.547655	10.016771	9.983229	45		43
18	30	9.435685	10.564315	9.452465	10.547535	10.016780	9.983220	30		42
19	45	9.435797	10.564203	9.452586	10.547414	10.016789	9.983211	15		41
20	50	9.435908	10.564092	9.452706	10.547294	10.016798	9.983202		10	40
21	15	9.436019	10.563981	9.452826	10.547174	10.016807	9.983193	45		39
22	30	9.436131	10.563869	9.452947	10.547053	10.016816	9.983184	30		38
23	45	9.436242	10.563758	9.453067	10.546933	10.016825	9.983175	15		37
24	51	9.436353	10.563647	9.453187	10.546813	10.016834	9.983166		9	36
25	15	9.436464	10.563536	9.453307	10.546693	10.016843	9.983157	45		35
26	30	9.436576	10.563424	9.453428	10.546572	10.016852	9.983148	30		34
27	45	9.436687	10.563313	9.453548	10.546452	10.016861	9.983139	15		33
28	52	9.436798	10.563202	9.453668	10.546332	10.016870	9.983130		8	32
29	15	9.436909	10.563091	9.453788	10.546212	10.016879	9.983121	45		31
30	30	9.437020	10.562980	9.453908	10.546092	10.016888	9.983112	30		30
31	45	9.437131	10.562869	9.454028	10.545972	10.016897	9.983103	15		29
32	53	9.437242	10.562758	9.454148	10.545852	10.016906	9.983094		7	28
33	15	9.437353	10.562647	9.454268	10.545732	10.016915	9.983085	45		27
34	30	9.437464	10.562536	9.454388	10.545612	10.016924	9.983076	30		26
35	45	9.437575	10.562425	9.454508	10.545492	10.016933	9.983067	15		25
36	54	9.437686	10.562314	9.454628	10.545372	10.016942	9.983058		6	24
37	15	9.437797	10.562203	9.454747	10.545253	10.016951	9.983049	45		23
38	30	9.437908	10.562092	9.454867	10.545133	10.016960	9.983040	30		22
39	45	9.438018	10.561982	9.454987	10.545013	10.016969	9.983031	15		21
40	55	9.438129	10.561871	9.455107	10.544893	10.016978	9.983022		5	20
41	15	9.438240	10.561760	9.455227	10.544773	10.016987	9.983013	45		19
42	30	9.438351	10.561649	9.455346	10.544654	10.016996	9.983004	30		18
43	45	9.438461	10.561539	9.455466	10.544534	10.017005	9.982995	15		17
44	56	9.438572	10.561428	9.455586	10.544414	10.017014	9.982986		4	16
45	15	9.438682	10.561318	9.455705	10.544295	10.017023	9.982977	45		15
46	30	9.438793	10.561207	9.455825	10.544175	10.017032	9.982968	30		14
47	45	9.438904	10.561096	9.455944	10.544056	10.017041	9.982959	15		13
48	57	9.439014	10.560986	9.456064	10.543936	10.017050	9.982950		3	12
49	15	9.439125	10.560875	9.456184	10.543816	10.017059	9.982941	45		11
50	30	9.439235	10.560765	9.456303	10.543697	10.017068	9.982932	30		10
51	45	9.439346	10.560654	9.456422	10.543578	10.017077	9.982923	15		9
52	58	9.439456	10.560544	9.456542	10.543458	10.017086	9.982914		2	8
53	15	9.439566	10.560434	9.456661	10.543339	10.017095	9.982905	45		7
54	30	9.439677	10.560323	9.456781	10.543219	10.017104	9.982896	30		6
55	45	9.439787	10.560213	9.456900	10.543100	10.017113	9.982887	15		5
56	59	9.439897	10.560103	9.457019	10.542981	10.017122	9.982878		1	4
57	15	9.440007	10.559993	9.457139	10.542861	10.017131	9.982869	45		3
58	30	9.440118	10.559882	9.457258	10.542742	10.017140	9.982860	30		2
59	45	9.440228	10.559772	9.457377	10.542623	10.017149	9.982851	15		1
60	60	9.440338	10.559662	9.457496	10.542504	10.017158	9.982842		0	0
sec.	"	co-sine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
4 ^h 56 ^m		LOG. SINES, &c.						74 deg.		

1 ^h 4 ^m .		LOG. SINES, &c. (t.)						16 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	0	9.440338	10.559662	9.457496	10.542504	10.017158	9.982842	60		60
1	15	9.440448	10.559552	9.457616	10.542384	10.017167	9.982833	45		59
2	30	9.440558	10.559442	9.457735	10.542265	10.017177	9.982823	30		58
3	45	9.440668	10.559332	9.457854	10.542146	10.017186	9.982814	15		57
4	1	9.440778	10.559222	9.457973	10.542027	10.017195	9.982805	59		56
5	15	9.440888	10.559112	9.458092	10.541908	10.017204	9.982796	45		55
6	30	9.440998	10.559002	9.458211	10.541789	10.017213	9.982787	30		54
7	45	9.441108	10.558892	9.458330	10.541670	10.017222	9.982778	15		53
8	2	9.441218	10.558782	9.458449	10.541551	10.017231	9.982769	58		52
9	15	9.441328	10.558672	9.458568	10.541432	10.017240	9.982760	45		51
10	30	9.441438	10.558562	9.458687	10.541313	10.017249	9.982751	30		50
11	45	9.441548	10.558452	9.458806	10.541194	10.017258	9.982742	15		49
12	3	9.441658	10.558342	9.458925	10.541075	10.017267	9.982733	57		48
13	15	9.441767	10.558233	9.459044	10.540956	10.017276	9.982724	45		47
14	30	9.441877	10.558123	9.459162	10.540837	10.017285	9.982715	30		46
15	45	9.441987	10.558013	9.459281	10.540719	10.017295	9.982705	15		45
16	4	9.442096	10.557904	9.459400	10.540600	10.017304	9.982696	56		44
17	15	9.442206	10.557794	9.459519	10.540481	10.017313	9.982687	45		43
18	30	9.442316	10.557684	9.459637	10.540363	10.017322	9.982678	30		42
19	45	9.442425	10.557575	9.459756	10.540244	10.017331	9.982669	15		41
20	5	9.442535	10.557465	9.459875	10.540125	10.017340	9.982660	55		40
21	15	9.442644	10.557356	9.459993	10.540007	10.017349	9.982651	45		39
22	30	9.442754	10.557246	9.460112	10.539888	10.017358	9.982642	30		38
23	45	9.442863	10.557137	9.460231	10.539769	10.017367	9.982633	15		37
24	6	9.442973	10.557027	9.460349	10.539651	10.017376	9.982624	54		36
25	15	9.443082	10.556918	9.460468	10.539532	10.017386	9.982614	45		35
26	30	9.443192	10.556808	9.460586	10.539414	10.017395	9.982605	30		34
27	45	9.443301	10.556699	9.460705	10.539295	10.017404	9.982596	15		33
28	7	9.443410	10.556590	9.460823	10.539177	10.017413	9.982587	53		32
29	15	9.443520	10.556480	9.460942	10.539058	10.017422	9.982578	45		31
30	30	9.443629	10.556371	9.461060	10.538940	10.017431	9.982569	30		30
31	45	9.443738	10.556262	9.461178	10.538822	10.017440	9.982560	15		29
32	8	9.443847	10.556153	9.461297	10.538703	10.017449	9.982551	52		28
33	15	9.443956	10.556044	9.461415	10.538585	10.017459	9.982541	45		27
34	30	9.444065	10.555935	9.461533	10.538467	10.017468	9.982532	30		26
35	45	9.444175	10.555825	9.461651	10.538349	10.017477	9.982523	15		25
36	9	9.444284	10.555716	9.461770	10.538230	10.017486	9.982514	51		24
37	15	9.444393	10.555607	9.461888	10.538112	10.017495	9.982505	45		23
38	30	9.444502	10.555498	9.462006	10.537994	10.017504	9.982496	30		22
39	45	9.444611	10.555389	9.462124	10.537876	10.017513	9.982487	15		21
40	10	9.444720	10.555280	9.462242	10.537758	10.017523	9.982477	50		20
41	15	9.444829	10.555171	9.462360	10.537640	10.017532	9.982468	45		19
42	30	9.444938	10.555062	9.462478	10.537522	10.017541	9.982459	30		18
43	45	9.445046	10.554954	9.462596	10.537404	10.017550	9.982450	15		17
44	11	9.445155	10.554845	9.462714	10.537286	10.017559	9.982441	49		16
45	15	9.445264	10.554736	9.462832	10.537168	10.017568	9.982432	45		15
46	30	9.445373	10.554627	9.462950	10.537050	10.017578	9.982422	30		14
47	45	9.445482	10.554518	9.463068	10.536932	10.017587	9.982413	15		13
48	12	9.445590	10.554410	9.463186	10.536814	10.017596	9.982404	48		12
49	15	9.445699	10.554301	9.463304	10.536696	10.017605	9.982395	45		11
50	30	9.445808	10.554192	9.463422	10.536578	10.017614	9.982386	30		10
51	45	9.445916	10.554084	9.463540	10.536460	10.017624	9.982376	15		9
52	13	9.446025	10.553975	9.463658	10.536342	10.017633	9.982367	47		8
53	15	9.446133	10.553867	9.463775	10.536225	10.017642	9.982358	45		7
54	30	9.446242	10.553758	9.463893	10.536107	10.017651	9.982349	30		6
55	45	9.446351	10.553649	9.464011	10.535989	10.017660	9.982340	15		5
56	14	9.446459	10.553541	9.464128	10.535872	10.017669	9.982331	46		4
57	15	9.446567	10.553433	9.464246	10.535754	10.017679	9.982321	45		3
58	30	9.446676	10.553324	9.464364	10.535636	10.017688	9.982312	30		2
59	45	9.446784	10.553216	9.464481	10.535519	10.017697	9.982303	15		1
60	15	9.446893	10.553107	9.464599	10.535401	10.017706	9.982294	45		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
4 ^h 55 ^m .		LOG. SINES, &c.						73 deg.		

1 ^h 5 ^m .		LOG. SINES, &c. (t.)						16 deg.	
sec.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.		sec.
0	15	9.446893	10.553107	9.464599	10.535401	10.017706	9.982294	45	60
1	15	9.447001	10.552999	9.464716	10.535284	10.017715	9.982285	45	59
2	30	9.447109	10.552891	9.464834	10.535166	10.017725	9.982275	30	58
3	45	9.447218	10.552782	9.464951	10.535049	10.017734	9.982266	15	57
4	16	9.447326	10.552674	9.465069	10.534931	10.017743	9.982257	44	56
5	15	9.447434	10.552566	9.465186	10.534814	10.017752	9.982248	45	55
6	30	9.447542	10.552458	9.465304	10.534696	10.017762	9.982238	30	54
7	45	9.447650	10.552350	9.465421	10.534579	10.017771	9.982229	15	53
8	17	9.447759	10.552241	9.465539	10.534461	10.017780	9.982220	43	52
9	15	9.447867	10.552133	9.465656	10.534344	10.017789	9.982211	45	51
10	30	9.447975	10.552025	9.465773	10.534227	10.017798	9.982202	30	50
11	45	9.448083	10.551917	9.465890	10.534110	10.017808	9.982192	15	49
12	18	9.448191	10.551809	9.466008	10.533992	10.017817	9.982183	42	48
13	15	9.448299	10.551701	9.466125	10.533875	10.017826	9.982174	45	47
14	30	9.448407	10.551593	9.466242	10.533758	10.017835	9.982165	30	46
15	45	9.448515	10.551485	9.466359	10.533641	10.017845	9.982155	15	45
16	19	9.448623	10.551377	9.466476	10.533524	10.017854	9.982146	41	44
17	15	9.448731	10.551269	9.466594	10.533406	10.017863	9.982137	45	43
18	30	9.448838	10.551162	9.466711	10.533289	10.017872	9.982128	30	42
19	45	9.448946	10.551054	9.466828	10.533172	10.017882	9.982118	15	41
20	20	9.449054	10.550946	9.466945	10.533055	10.017891	9.982109	40	40
21	15	9.449162	10.550838	9.467062	10.532938	10.017900	9.982100	45	39
22	30	9.449269	10.550731	9.467179	10.532821	10.017909	9.982091	30	38
23	45	9.449377	10.550623	9.467296	10.532704	10.017919	9.982081	15	37
24	21	9.449485	10.550515	9.467413	10.532587	10.017928	9.982072	39	36
25	15	9.449592	10.550408	9.467530	10.532470	10.017937	9.982063	45	35
26	30	9.449700	10.550300	9.467646	10.532354	10.017946	9.982054	30	34
27	45	9.449808	10.550192	9.467763	10.532237	10.017956	9.982044	15	33
28	22	9.449915	10.550085	9.467880	10.532120	10.017965	9.982035	38	32
29	15	9.450023	10.549977	9.467997	10.532003	10.017974	9.982026	45	31
30	30	9.450130	10.549870	9.468114	10.531886	10.017984	9.982016	30	30
31	45	9.450238	10.549762	9.468230	10.531770	10.017993	9.982007	15	29
32	23	9.450345	10.549655	9.468347	10.531653	10.018002	9.981998	37	28
33	15	9.450453	10.549547	9.468464	10.531536	10.018011	9.981989	45	27
34	30	9.450560	10.549440	9.468581	10.531419	10.018021	9.981979	30	26
35	45	9.450667	10.549333	9.468697	10.531303	10.018030	9.981970	15	25
36	24	9.450775	10.549225	9.468814	10.531186	10.018039	9.981961	36	24
37	15	9.450882	10.549118	9.468930	10.531070	10.018049	9.981951	45	23
38	30	9.450989	10.549011	9.469047	10.530953	10.018058	9.981942	30	22
39	45	9.451096	10.548904	9.469164	10.530836	10.018067	9.981933	15	21
40	25	9.451204	10.548796	9.469280	10.530720	10.018076	9.981924	35	20
41	15	9.451311	10.548689	9.469397	10.530603	10.018086	9.981914	45	19
42	30	9.451418	10.548582	9.469513	10.530487	10.018095	9.981905	30	18
43	45	9.451525	10.548475	9.469629	10.530371	10.018104	9.981896	15	17
44	26	9.451632	10.548368	9.469746	10.530254	10.018114	9.981886	34	16
45	15	9.451739	10.548261	9.469862	10.530138	10.018123	9.981877	45	15
46	30	9.451846	10.548154	9.469979	10.530021	10.018132	9.981868	30	14
47	45	9.451953	10.548047	9.470095	10.529905	10.018142	9.981858	15	13
48	27	9.452060	10.547940	9.470211	10.529789	10.018151	9.981849	33	12
49	15	9.452167	10.547833	9.470327	10.529673	10.018160	9.981840	45	11
50	30	9.452274	10.547726	9.470444	10.529556	10.018170	9.981830	30	10
51	45	9.452381	10.547619	9.470560	10.529440	10.018179	9.981821	15	9
52	28	9.452488	10.547512	9.470676	10.529324	10.018188	9.981812	32	8
53	15	9.452595	10.547405	9.470792	10.529208	10.018198	9.981802	45	7
54	30	9.452702	10.547298	9.470908	10.529092	10.018207	9.981793	30	6
55	45	9.452808	10.547192	9.471025	10.528975	10.018216	9.981784	15	5
56	29	9.452915	10.547085	9.471141	10.528859	10.018226	9.981774	31	4
57	15	9.453022	10.546978	9.471257	10.528743	10.018235	9.981765	45	3
58	30	9.453128	10.546872	9.471373	10.528627	10.018244	9.981756	30	2
59	45	9.453235	10.546765	9.471489	10.528511	10.018254	9.981746	15	1
60	30	9.453342	10.546658	9.471605	10.528395	10.018263	9.981737	30	0
sec.		cosine.	secant.	cotangent.	tangent.	cosecant.	sine.		sec.
4 ^h 54 ^m .		LOG. SINES, &c.						73 deg.	

1 ^h 6 ^m .			LOG. SINES, &c. (t.)						16 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0	30		9.453342	10.546658	9.471605	10.528395	10.018263	9.981737	30		60
1		15	9.453448	10.546552	9.471721	10.528279	10.018272	9.981728	45		59
2		30	9.453555	10.546445	9.471837	10.528163	10.018282	9.981718	30		58
3		45	9.453661	10.546339	9.471953	10.528047	10.018291	9.981709	15		57
4	31		9.453768	10.546232	9.472068	10.527932	10.018301	9.981699		29	56
5		15	9.453875	10.546125	9.472184	10.527816	10.018310	9.981690	45		55
6		30	9.453981	10.546019	9.472300	10.527700	10.018319	9.981681	30		54
7		45	9.454087	10.545913	9.472416	10.527584	10.018329	9.981671	15		53
8	32		9.454194	10.545806	9.472532	10.527468	10.018338	9.981662		28	52
9		15	9.454300	10.545700	9.472648	10.527352	10.018347	9.981653	45		51
10		30	9.454407	10.545593	9.472763	10.527237	10.018357	9.981643	30		50
11		45	9.454513	10.545487	9.472879	10.527121	10.018366	9.981634	15		49
12	33		9.454619	10.545381	9.472995	10.527005	10.018376	9.981624		27	48
13		15	9.454725	10.545275	9.473110	10.526890	10.018385	9.981615	45		47
14		30	9.454832	10.545168	9.473226	10.526774	10.018394	9.981606	30		46
15		45	9.454938	10.545062	9.473342	10.526658	10.018404	9.981596	15		45
16	34		9.455044	10.544956	9.473457	10.526543	10.018413	9.981587		26	44
17		15	9.455150	10.544850	9.473573	10.526427	10.018422	9.981578	45		43
18		30	9.455256	10.544744	9.473688	10.526312	10.018432	9.981568	30		42
19		45	9.455362	10.544638	9.473804	10.526196	10.018441	9.981559	15		41
20	35		9.455469	10.544531	9.473919	10.526081	10.018451	9.981549		25	40
21		15	9.455575	10.544425	9.474035	10.525965	10.018460	9.981540	45		39
22		30	9.455681	10.544319	9.474150	10.525850	10.018470	9.981530	30		38
23		45	9.455787	10.544213	9.474265	10.525735	10.018479	9.981521	15		37
24	36		9.455893	10.544107	9.474381	10.525619	10.018488	9.981512		24	36
25		15	9.455998	10.544002	9.474496	10.525504	10.018498	9.981502	45		35
26		30	9.456104	10.543896	9.474611	10.525389	10.018507	9.981493	30		34
27		45	9.456210	10.543790	9.474727	10.525273	10.018517	9.981483	15		33
28	37		9.456316	10.543684	9.474842	10.525158	10.018526	9.981474		23	32
29		15	9.456422	10.543578	9.474957	10.525043	10.018535	9.981465	45		31
30		30	9.456528	10.543472	9.475072	10.524928	10.018545	9.981455	30		30
31		45	9.456633	10.543367	9.475188	10.524812	10.018554	9.981446	15		29
32	38		9.456739	10.543261	9.475303	10.524697	10.018564	9.981436		22	28
33		15	9.456845	10.543155	9.475418	10.524582	10.018573	9.981427	45		27
34		30	9.456951	10.543049	9.475533	10.524467	10.018583	9.981417	30		26
35		45	9.457056	10.542944	9.475648	10.524352	10.018592	9.981408	15		25
36	39		9.457162	10.542838	9.475763	10.524237	10.018601	9.981399		21	24
37		15	9.457267	10.542733	9.475878	10.524122	10.018611	9.981389	45		23
38		30	9.457373	10.542627	9.475993	10.524007	10.018620	9.981380	30		22
39		45	9.457478	10.542522	9.476108	10.523892	10.018630	9.981370	15		21
40	40		9.457584	10.542416	9.476223	10.523777	10.018639	9.981361		20	20
41		15	9.457689	10.542311	9.476338	10.523662	10.018649	9.981351	45		19
42		30	9.457795	10.542205	9.476453	10.523547	10.018658	9.981342	30		18
43		45	9.457900	10.542100	9.476568	10.523432	10.018668	9.981332	15		17
44	41		9.458006	10.541994	9.476683	10.523317	10.018677	9.981323		19	16
45		15	9.458111	10.541889	9.476798	10.523202	10.018687	9.981313	45		15
46		30	9.458216	10.541784	9.476912	10.523088	10.018696	9.981304	30		14
47		45	9.458322	10.541678	9.477027	10.522973	10.018706	9.981294	15		13
48	42		9.458427	10.541573	9.477142	10.522858	10.018715	9.981285		18	12
49		15	9.458532	10.541468	9.477257	10.522743	10.018724	9.981276	45		11
50		30	9.458638	10.541362	9.477371	10.522629	10.018734	9.981266	30		10
51		45	9.458743	10.541257	9.477486	10.522514	10.018743	9.981257	15		9
52	43		9.458848	10.541152	9.477601	10.522399	10.018753	9.981247		17	8
53		15	9.458953	10.541047	9.477715	10.522285	10.018762	9.981238	45		7
54		30	9.459058	10.540942	9.477830	10.522170	10.018772	9.981228	30		6
55		45	9.459163	10.540837	9.477945	10.522055	10.018781	9.981219	15		5
56	44		9.459268	10.540732	9.478059	10.521941	10.018791	9.981209		16	4
57		15	9.459373	10.540627	9.478174	10.521826	10.018800	9.981200	45		3
58		30	9.459478	10.540522	9.478288	10.521712	10.018810	9.981190	30		2
59		45	9.459583	10.540417	9.478403	10.521597	10.018819	9.981181	15		1
60	45		9.459688	10.540312	9.478517	10.521483	10.018829	9.981171		15	0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.
4 ^h 53 ^m .			LOG. SINES, &c.						73 deg.		

1 ^h 7 ^m .		LOG. SINES, &c. (t)						16 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.459688	10.540312	9.478517	10.521483	10.018829	9.981171	15	60
1	15	9.459793	10.540207	9.478632	10.521368	10.018838	9.981162	45	59
2	30	9.459898	10.540102	9.478746	10.521254	10.018848	9.981152	30	58
3	45	9.460003	10.539997	9.478860	10.521140	10.018857	9.981143	15	57
4	46	9.460108	10.539892	9.478975	10.521025	10.018867	9.981133	14	56
5	15	9.460213	10.539787	9.479089	10.520911	10.018876	9.981124	45	55
6	30	9.460317	10.539683	9.479203	10.520797	10.018886	9.981114	30	54
7	45	9.460422	10.539578	9.479318	10.520682	10.018896	9.981104	15	53
8	47	9.460527	10.539473	9.479432	10.520568	10.018905	9.981095	13	52
9	15	9.460632	10.539368	9.479546	10.520454	10.018915	9.981085	45	51
10	30	9.460736	10.539264	9.479660	10.520340	10.018924	9.981076	30	50
11	45	9.460841	10.539159	9.479775	10.520225	10.018934	9.981066	15	49
12	48	9.460946	10.539054	9.479889	10.520111	10.018943	9.981057	12	48
13	15	9.461050	10.538950	9.480003	10.519997	10.018953	9.981047	45	47
14	30	9.461155	10.538845	9.480117	10.519883	10.018962	9.981038	30	46
15	45	9.461259	10.538741	9.480231	10.519769	10.018972	9.981028	15	45
16	49	9.461364	10.538636	9.480345	10.519655	10.018981	9.981019	11	44
17	15	9.461468	10.538532	9.480459	10.519541	10.018991	9.981009	45	43
18	30	9.461573	10.538427	9.480573	10.519427	10.019000	9.981000	30	42
19	45	9.461677	10.538323	9.480687	10.519313	10.019010	9.980990	15	41
20	50	9.461782	10.538218	9.480801	10.519199	10.019020	9.980980	10	40
21	15	9.461886	10.538114	9.480915	10.519085	10.019029	9.980971	45	39
22	30	9.461990	10.538010	9.481029	10.518971	10.019039	9.980961	30	38
23	45	9.462095	10.537905	9.481143	10.518857	10.019048	9.980952	15	37
24	51	9.462199	10.537801	9.481257	10.518743	10.019058	9.980942	9	36
25	15	9.462303	10.537697	9.481370	10.518630	10.019067	9.980933	45	35
26	30	9.462407	10.537593	9.481484	10.518516	10.019077	9.980923	30	34
27	45	9.462512	10.537488	9.481598	10.518402	10.019086	9.980914	15	33
28	52	9.462616	10.537384	9.481712	10.518288	10.019096	9.980904	8	32
29	15	9.462720	10.537280	9.481825	10.518175	10.019106	9.980894	45	31
30	30	9.462824	10.537176	9.481939	10.518061	10.019115	9.980885	30	30
31	45	9.462928	10.537072	9.482053	10.517947	10.019125	9.980875	15	29
32	53	9.463032	10.536968	9.482167	10.517833	10.019134	9.980866	7	28
33	15	9.463136	10.536864	9.482280	10.517720	10.019144	9.980856	45	27
34	30	9.463240	10.536760	9.482394	10.517606	10.019154	9.980846	30	26
35	45	9.463344	10.536656	9.482507	10.517493	10.019163	9.980837	15	25
36	54	9.463448	10.536552	9.482621	10.517379	10.019173	9.980827	6	24
37	15	9.463552	10.536448	9.482734	10.517266	10.019182	9.980818	45	23
38	30	9.463656	10.536344	9.482848	10.517152	10.019192	9.980808	30	22
39	45	9.463760	10.536240	9.482961	10.517039	10.019202	9.980798	15	21
40	55	9.463864	10.536136	9.483075	10.516925	10.019211	9.980789	5	20
41	15	9.463968	10.536032	9.483188	10.516812	10.019221	9.980779	45	19
42	30	9.464071	10.535929	9.483302	10.516698	10.019230	9.980770	30	18
43	45	9.464175	10.535825	9.483415	10.516585	10.019240	9.980760	15	17
44	56	9.464279	10.535721	9.483529	10.516471	10.019250	9.980750	4	16
45	15	9.464383	10.535617	9.483642	10.516358	10.019259	9.980741	45	15
46	30	9.464486	10.535514	9.483755	10.516245	10.019269	9.980731	30	14
47	45	9.464590	10.535410	9.483868	10.516132	10.019278	9.980722	15	13
48	57	9.464694	10.535306	9.483982	10.516018	10.019288	9.980712	3	12
49	15	9.464797	10.535203	9.484095	10.515905	10.019298	9.980702	45	11
50	30	9.464901	10.535099	9.484208	10.515792	10.019307	9.980693	30	10
51	45	9.465004	10.534996	9.484321	10.515679	10.019317	9.980683	15	9
52	58	9.465108	10.534892	9.484435	10.515565	10.019327	9.980673	2	8
53	15	9.465212	10.534788	9.484548	10.515452	10.019336	9.980664	45	7
54	30	9.465315	10.534685	9.484661	10.515339	10.019346	9.980654	30	6
55	45	9.465418	10.534582	9.484774	10.515226	10.019355	9.980645	15	5
56	59	9.465522	10.534478	9.484887	10.515113	10.019365	9.980635	1	4
57	15	9.465625	10.534375	9.485000	10.515000	10.019375	9.980625	45	3
58	30	9.465729	10.534271	9.485113	10.514887	10.019384	9.980616	30	2
59	45	9.465832	10.534168	9.485226	10.514774	10.019394	9.980606	15	1
60	60	9.465935	10.534065	9.485339	10.514661	10.019404	9.980596	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 52 ^m .		LOG. SINES, &c.						73 deg	

1 ^h 5 ^m .		LOG. SINES, &c. (t.)						17 deg.	
sec.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.465935	10.534065	9.485339	10.514661	10.019404	9.980596	60	60
1	15	9.466039	10.533961	9.485452	10.514548	10.019413	9.980587	45	59
2	30	9.466142	10.533858	9.485565	10.514435	10.019423	9.980577	30	58
3	45	9.466245	10.533755	9.485678	10.514322	10.019433	9.980567	15	57
4	1	9.466348	10.533652	9.485791	10.514209	10.019442	9.980558	59	56
5	15	9.466451	10.533549	9.485903	10.514097	10.019452	9.980548	45	55
6	30	9.466555	10.533445	9.486016	10.513984	10.019462	9.980538	30	54
7	45	9.466658	10.533342	9.486129	10.513871	10.019471	9.980529	15	53
8	2	9.466761	10.533239	9.486242	10.513758	10.019481	9.980519	58	52
9	15	9.466864	10.533136	9.486355	10.513645	10.019491	9.980509	45	51
10	30	9.466967	10.533033	9.486467	10.513533	10.019500	9.980500	30	50
11	45	9.467070	10.532930	9.486580	10.513420	10.019510	9.980490	15	49
12	3	9.467173	10.532827	9.486693	10.513307	10.019520	9.980480	57	48
13	15	9.467276	10.532724	9.486805	10.513195	10.019529	9.980471	45	47
14	30	9.467379	10.532621	9.486918	10.513082	10.019539	9.980461	30	46
15	45	9.467482	10.532518	9.487031	10.512969	10.019549	9.980451	15	45
16	4	9.467585	10.532415	9.487143	10.512857	10.019559	9.980441	56	44
17	15	9.467688	10.532312	9.487256	10.512744	10.019568	9.980432	45	43
18	30	9.467790	10.532210	9.487368	10.512632	10.019578	9.980422	30	42
19	45	9.467893	10.532107	9.487481	10.512519	10.019588	9.980412	15	41
20	5	9.467996	10.532004	9.487593	10.512407	10.019597	9.980403	55	40
21	15	9.468099	10.531901	9.487706	10.512294	10.019607	9.980393	45	39
22	30	9.468201	10.531799	9.487818	10.512182	10.019617	9.980383	30	38
23	45	9.468304	10.531696	9.487931	10.512069	10.019626	9.980373	15	37
24	6	9.468407	10.531593	9.488043	10.511957	10.019636	9.980364	54	36
25	15	9.468509	10.531491	9.488155	10.511845	10.019646	9.980354	45	35
26	30	9.468612	10.531388	9.488268	10.511732	10.019656	9.980344	30	34
27	45	9.468715	10.531285	9.488380	10.511620	10.019665	9.980335	15	33
28	7	9.468817	10.531183	9.488492	10.511508	10.019675	9.980325	53	32
29	15	9.468920	10.531080	9.488605	10.511395	10.019685	9.980315	45	31
30	30	9.469022	10.530978	9.488717	10.511283	10.019695	9.980305	30	30
31	45	9.469125	10.530875	9.488829	10.511171	10.019704	9.980296	15	29
32	8	9.469227	10.530773	9.488941	10.511059	10.019714	9.980286	52	28
33	15	9.469330	10.530670	9.489053	10.510947	10.019724	9.980276	45	27
34	30	9.469432	10.530568	9.489166	10.510834	10.019733	9.980267	30	26
35	45	9.469535	10.530465	9.489278	10.510722	10.019743	9.980257	15	25
36	9	9.469637	10.530363	9.489390	10.510610	10.019753	9.980247	51	24
37	15	9.469739	10.530261	9.489502	10.510498	10.019763	9.980237	45	23
38	30	9.469842	10.530158	9.489614	10.510386	10.019772	9.980228	30	22
39	45	9.469944	10.530056	9.489726	10.510274	10.019782	9.980218	15	21
40	10	9.470046	10.529954	9.489838	10.510162	10.019792	9.980208	50	20
41	15	9.470148	10.529852	9.489950	10.510050	10.019802	9.980198	45	19
42	30	9.470250	10.529750	9.490062	10.509938	10.019811	9.980189	30	18
43	45	9.470353	10.529647	9.490174	10.509826	10.019821	9.980179	15	17
44	11	9.470455	10.529545	9.490286	10.509714	10.019831	9.980169	49	16
45	15	9.470557	10.529443	9.490398	10.509602	10.019841	9.980159	45	15
46	30	9.470659	10.529341	9.490510	10.509490	10.019851	9.980149	30	14
47	45	9.470761	10.529239	9.490621	10.509379	10.019860	9.980140	15	13
48	12	9.470863	10.529137	9.490733	10.509267	10.019870	9.980130	48	12
49	15	9.470965	10.529035	9.490845	10.509155	10.019880	9.980120	45	11
50	30	9.471067	10.528933	9.490957	10.509043	10.019890	9.980110	30	10
51	45	9.471169	10.528831	9.491068	10.508932	10.019899	9.980101	15	9
52	13	9.471271	10.528729	9.491180	10.508820	10.019909	9.980091	47	8
53	15	9.471373	10.528627	9.491292	10.508708	10.019919	9.980081	45	7
54	30	9.471475	10.528525	9.491404	10.508596	10.019929	9.980071	30	6
55	45	9.471577	10.528423	9.491515	10.508485	10.019939	9.980061	15	5
56	14	9.471678	10.528322	9.491627	10.508373	10.019948	9.980052	46	4
57	15	9.471780	10.528220	9.491738	10.508262	10.019958	9.980042	45	3
58	30	9.471882	10.528118	9.491850	10.508150	10.019968	9.980032	30	2
59	45	9.471984	10.528016	9.491962	10.508038	10.019978	9.980022	15	1
60	15	9.472086	10.527914	9.492073	10.507927	10.019988	9.980012	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

4^h 51^m.

LOG. SINES, &c

72 deg.

1 ^h 9 ^m .		LOG. SINES, &c. (t)						17 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.472086	10.527914	9.492073	10.507927	10.019988	9.980012	45	60
1	15	9.472187	10.527813	9.492185	10.507815	10.019997	9.980003	45	59
2	30	9.472289	10.527711	9.492296	10.507704	10.020007	9.979993	30	58
3	45	9.472391	10.527609	9.492408	10.507592	10.020017	9.979983	15	57
4	16	9.472492	10.527508	9.492519	10.507481	10.020027	9.979973	44	56
5	15	9.472594	10.527406	9.492630	10.507370	10.020037	9.979963	45	55
6	30	9.472695	10.527305	9.492742	10.507258	10.020046	9.979954	30	54
7	45	9.472797	10.527203	9.492853	10.507147	10.020056	9.979944	15	53
8	17	9.472898	10.527102	9.492965	10.507035	10.020066	9.979934	43	52
9	15	9.473000	10.527000	9.493076	10.506924	10.020076	9.979924	45	51
10	30	9.473101	10.526899	9.493187	10.506813	10.020086	9.979914	30	50
11	45	9.473203	10.526797	9.493298	10.506702	10.020096	9.979904	15	49
12	18	9.473304	10.526696	9.493410	10.506590	10.020105	9.979895	42	48
13	15	9.473406	10.526594	9.493521	10.506479	10.020115	9.979885	45	47
14	30	9.473507	10.526493	9.493632	10.506368	10.020125	9.979875	30	46
15	45	9.473608	10.526392	9.493743	10.506257	10.020135	9.979865	15	45
16	19	9.473710	10.526290	9.493854	10.506146	10.020145	9.979855	41	44
17	15	9.473811	10.526189	9.493966	10.506034	10.020155	9.979845	45	43
18	30	9.473912	10.526088	9.494077	10.505923	10.020165	9.979835	30	42
19	45	9.474013	10.525987	9.494188	10.505812	10.020174	9.979826	15	41
20	20	9.474115	10.525885	9.494299	10.505701	10.020184	9.979816	40	40
21	15	9.474216	10.525784	9.494410	10.505590	10.020194	9.979806	45	39
22	30	9.474317	10.525683	9.494521	10.505479	10.020204	9.979796	30	38
23	45	9.474418	10.525582	9.494632	10.505368	10.020214	9.979786	15	37
24	21	9.474519	10.525481	9.494743	10.505257	10.020224	9.979776	39	36
25	15	9.474620	10.525380	9.494854	10.505146	10.020234	9.979766	45	35
26	30	9.474721	10.525279	9.494965	10.505035	10.020243	9.979757	30	34
27	45	9.474822	10.525178	9.495076	10.504924	10.020253	9.979747	15	33
28	22	9.474923	10.525077	9.495186	10.504814	10.020263	9.979737	38	32
29	15	9.475024	10.524976	9.495297	10.504703	10.020273	9.979727	45	31
30	30	9.475125	10.524875	9.495408	10.504592	10.020283	9.979717	30	30
31	45	9.475226	10.524774	9.495519	10.504481	10.020293	9.979707	15	29
32	23	9.475327	10.524673	9.495630	10.504370	10.020303	9.979697	37	28
33	15	9.475428	10.524572	9.495740	10.504260	10.020313	9.979687	45	27
34	30	9.475529	10.524471	9.495851	10.504149	10.020322	9.979678	30	26
35	45	9.475630	10.524370	9.495962	10.504038	10.020332	9.979668	15	25
36	24	9.475730	10.524270	9.496073	10.503927	10.020342	9.979658	36	24
37	15	9.475831	10.524169	9.496183	10.503817	10.020352	9.979648	45	23
38	30	9.475932	10.524068	9.496294	10.503706	10.020362	9.979638	30	22
39	45	9.476033	10.523967	9.496405	10.503595	10.020372	9.979628	15	21
40	25	9.476133	10.523867	9.496515	10.503485	10.020382	9.979618	35	20
41	15	9.476234	10.523766	9.496626	10.503374	10.020392	9.979608	45	19
42	30	9.476335	10.523665	9.496736	10.503264	10.020402	9.979598	30	18
43	45	9.476435	10.523565	9.496847	10.503153	10.020412	9.979588	15	17
44	26	9.476536	10.523464	9.496957	10.503043	10.020422	9.979578	34	16
45	15	9.476636	10.523364	9.497068	10.502932	10.020431	9.979569	45	15
46	30	9.476737	10.523263	9.497178	10.502822	10.020441	9.979559	30	14
47	45	9.476837	10.523163	9.497289	10.502711	10.020451	9.979549	15	13
48	27	9.476938	10.523062	9.497399	10.502601	10.020461	9.979539	33	12
49	15	9.477038	10.522962	9.497509	10.502491	10.020471	9.979529	45	11
50	30	9.477139	10.522861	9.497620	10.502380	10.020481	9.979519	30	10
51	45	9.477239	10.522761	9.497730	10.502270	10.020491	9.979509	15	9
52	28	9.477340	10.522660	9.497841	10.502159	10.020501	9.979499	32	8
53	15	9.477440	10.522560	9.497951	10.502049	10.020511	9.979489	45	7
54	30	9.477540	10.522460	9.498061	10.501939	10.020521	9.979479	30	6
55	45	9.477641	10.522359	9.498171	10.501829	10.020531	9.979469	15	5
56	29	9.477741	10.522259	9.498282	10.501718	10.020541	9.979459	31	4
57	15	9.477841	10.522159	9.498392	10.501608	10.020551	9.979449	45	3
58	30	9.477941	10.522059	9.498502	10.501498	10.020561	9.979439	30	2
59	45	9.478042	10.521958	9.498612	10.501388	10.020571	9.979429	15	1
60	30	9.478142	10.521858	9.498722	10.501278	10.020581	9.979419	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 50 ^m .		LOG. SINES, &c.						72 deg.	

1 ^h 10 ^m .		LOG. SINES, &c. (t.)						17 deg	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.478142	10.521858	9.498722	10.501278	10.020581	9.979419	30	60
1	15	9.478242	10.521758	9.498832	10.501168	10.020591	9.979409	45	59
2	30	9.478342	10.521658	9.498942	10.501058	10.020600	9.979400	30	58
3	45	9.478442	10.521558	9.499053	10.500947	10.020610	9.979390	15	57
4	31	9.478542	10.521458	9.499163	10.500837	10.020620	9.979380	29	56
5	15	9.478642	10.521358	9.499273	10.500727	10.020630	9.979370	45	55
6	30	9.478742	10.521258	9.499383	10.500617	10.020640	9.979360	30	54
7	45	9.478842	10.521158	9.499493	10.500507	10.020650	9.979350	15	53
8	32	9.478942	10.521058	9.499603	10.500397	10.020660	9.979340	28	52
9	15	9.479042	10.520958	9.499712	10.500288	10.020670	9.979330	45	51
10	30	9.479142	10.520858	9.499822	10.500178	10.020680	9.979320	30	50
11	45	9.479242	10.520758	9.499932	10.500068	10.020690	9.979310	15	49
12	33	9.479342	10.520658	9.500042	10.499958	10.020700	9.979300	27	48
13	15	9.479442	10.520558	9.500152	10.499848	10.020710	9.979290	45	47
14	30	9.479542	10.520458	9.500262	10.499738	10.020720	9.979280	30	46
15	45	9.479642	10.520358	9.500372	10.499628	10.020730	9.979270	15	45
16	34	9.479741	10.520259	9.500481	10.499519	10.020740	9.979260	26	44
17	15	9.479841	10.520159	9.500591	10.499409	10.020750	9.979250	45	43
18	30	9.479941	10.520059	9.500701	10.499299	10.020760	9.979240	30	42
19	45	9.480040	10.519960	9.500811	10.499189	10.020770	9.979230	15	41
20	35	9.480140	10.519860	9.500920	10.499080	10.020780	9.979220	25	40
21	15	9.480240	10.519760	9.501030	10.498970	10.020790	9.979210	45	39
22	30	9.480339	10.519661	9.501140	10.498860	10.020800	9.979200	30	38
23	45	9.480439	10.519561	9.501249	10.498751	10.020810	9.979190	15	37
24	36	9.480538	10.519462	9.501359	10.498641	10.020820	9.979180	24	36
25	15	9.480638	10.519362	9.501468	10.498532	10.020830	9.979170	45	35
26	30	9.480738	10.519262	9.501578	10.498422	10.020840	9.979160	30	34
27	45	9.480837	10.519163	9.501687	10.498313	10.020850	9.979150	15	33
28	37	9.480937	10.519063	9.501797	10.498203	10.020860	9.979140	23	32
29	15	9.481036	10.518964	9.501906	10.498094	10.020870	9.979130	45	31
30	30	9.481135	10.518865	9.502016	10.497984	10.020880	9.979120	30	30
31	45	9.481235	10.518765	9.502125	10.497875	10.020890	9.979110	15	29
32	38	9.481334	10.518666	9.502235	10.497765	10.020900	9.979100	22	28
33	15	9.481434	10.518566	9.502344	10.497656	10.020911	9.979089	45	27
34	30	9.481533	10.518467	9.502453	10.497547	10.020921	9.979079	30	26
35	45	9.481632	10.518368	9.502563	10.497437	10.020931	9.979069	15	25
36	39	9.481731	10.518269	9.502672	10.497328	10.020941	9.979059	21	24
37	15	9.481831	10.518169	9.502781	10.497219	10.020951	9.979049	45	23
38	30	9.481930	10.518070	9.502891	10.497109	10.020961	9.979039	30	22
39	45	9.482029	10.517971	9.503000	10.497000	10.020971	9.979029	15	21
40	40	9.482128	10.517872	9.503109	10.496891	10.020981	9.979019	20	20
41	15	9.482227	10.517773	9.503218	10.496782	10.020991	9.979009	45	19
42	30	9.482327	10.517673	9.503328	10.496672	10.021001	9.978999	30	18
43	45	9.482426	10.517574	9.503437	10.496563	10.021011	9.978989	15	17
44	41	9.482525	10.517475	9.503546	10.496454	10.021021	9.978979	19	16
45	15	9.482624	10.517376	9.503655	10.496345	10.021031	9.978969	45	15
46	30	9.482723	10.517277	9.503764	10.496236	10.021041	9.978959	30	14
47	45	9.482822	10.517178	9.503873	10.496127	10.021051	9.978949	15	13
48	42	9.482921	10.517079	9.503982	10.496018	10.021061	9.978939	18	12
49	15	9.483020	10.516980	9.504091	10.495909	10.021072	9.978928	45	11
50	30	9.483119	10.516881	9.504200	10.495800	10.021082	9.978918	30	10
51	45	9.483218	10.516782	9.504309	10.495691	10.021092	9.978908	15	9
52	43	9.483316	10.516684	9.504418	10.495582	10.021102	9.978898	17	8
53	15	9.483415	10.516585	9.504527	10.495473	10.021112	9.978888	45	7
54	30	9.483514	10.516486	9.504636	10.495364	10.021122	9.978878	30	6
55	45	9.483613	10.516387	9.504745	10.495255	10.021132	9.978868	15	5
56	44	9.483712	10.516288	9.504854	10.495146	10.021142	9.978858	16	4
57	15	9.483810	10.516190	9.504963	10.495037	10.021152	9.978848	45	3
58	30	9.483909	10.516091	9.505071	10.494929	10.021162	9.978838	30	2
59	45	9.484008	10.515992	9.505180	10.494820	10.021172	9.978828	15	1
60	45	9.484107	10.515893	9.505289	10.494711	10.021183	9.978817	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 49 ^m .		LOG. SINES, &c.						72 deg.	

1 ^h 11 ^m .		LOG. SINES, &c. (t)						17 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.484107	10.515893	9.505289	10.494711	10.021183	9.978817	15	60
1	15	9.484205	10.515795	9.505398	10.494602	10.021193	9.978807	45	59
2	30	9.484304	10.515696	9.505507	10.494493	10.021203	9.978797	30	58
3	45	9.484402	10.515598	9.505615	10.494385	10.021213	9.978787	15	57
4	46	9.484501	10.515499	9.505724	10.494276	10.021223	9.978777	14	56
5	15	9.484600	10.515400	9.505833	10.494167	10.021233	9.978767	45	55
6	30	9.484698	10.515302	9.505941	10.494059	10.021243	9.978757	30	54
7	45	9.484797	10.515203	9.506050	10.493950	10.021253	9.978747	15	53
8	47	9.484895	10.515105	9.506159	10.493841	10.021264	9.978736	13	52
9	15	9.484994	10.515006	9.506267	10.493733	10.021274	9.978726	45	51
10	30	9.485092	10.514908	9.506376	10.493624	10.021284	9.978716	30	50
11	45	9.485190	10.514810	9.506484	10.493516	10.021294	9.978706	15	49
12	48	9.485289	10.514711	9.506593	10.493407	10.021304	9.978696	12	48
13	15	9.485387	10.514613	9.506701	10.493299	10.021314	9.978686	45	47
14	30	9.485485	10.514515	9.506810	10.493190	10.021324	9.978676	30	46
15	45	9.485584	10.514416	9.506918	10.493082	10.021335	9.978665	15	45
16	49	9.485682	10.514318	9.507027	10.492973	10.021345	9.978655	11	44
17	15	9.485780	10.514220	9.507135	10.492865	10.021355	9.978645	45	43
18	30	9.485878	10.514122	9.507243	10.492757	10.021365	9.978635	30	42
19	45	9.485977	10.514023	9.507352	10.492648	10.021375	9.978625	15	41
20	50	9.486075	10.513925	9.507460	10.492540	10.021385	9.978615	10	40
21	15	9.486173	10.513827	9.507568	10.492432	10.021395	9.978605	45	39
22	30	9.486271	10.513729	9.507677	10.492323	10.021406	9.978594	30	38
23	45	9.486369	10.513631	9.507785	10.492215	10.021416	9.978584	15	37
24	51	9.486467	10.513533	9.507893	10.492107	10.021426	9.978574	9	36
25	15	9.486565	10.513435	9.508002	10.491998	10.021436	9.978564	45	35
26	30	9.486663	10.513337	9.508110	10.491890	10.021446	9.978554	30	34
27	45	9.486761	10.513239	9.508218	10.491782	10.021456	9.978544	15	33
28	52	9.486859	10.513141	9.508326	10.491674	10.021467	9.978533	8	32
29	15	9.486957	10.513043	9.508434	10.491566	10.021477	9.978523	45	31
30	30	9.487055	10.512945	9.508542	10.491458	10.021487	9.978513	30	30
31	45	9.487153	10.512847	9.508650	10.491350	10.021497	9.978503	15	29
32	53	9.487251	10.512749	9.508759	10.491241	10.021507	9.978493	7	28
33	15	9.487349	10.512651	9.508867	10.491133	10.021518	9.978482	45	27
34	30	9.487447	10.512553	9.508975	10.491025	10.021528	9.978472	30	26
35	45	9.487545	10.512455	9.509083	10.490917	10.021538	9.978462	15	25
36	54	9.487643	10.512357	9.509191	10.490809	10.021548	9.978452	6	24
37	15	9.487740	10.512260	9.509299	10.490701	10.021558	9.978442	45	23
38	30	9.487838	10.512162	9.509407	10.490593	10.021569	9.978431	30	22
39	45	9.487936	10.512064	9.509514	10.490486	10.021579	9.978421	15	21
40	55	9.488033	10.511967	9.509622	10.490378	10.021589	9.978411	5	20
41	15	9.488131	10.511869	9.509730	10.490270	10.021599	9.978401	45	19
42	30	9.488229	10.511771	9.509838	10.490162	10.021609	9.978391	30	18
43	45	9.488326	10.511674	9.509946	10.490054	10.021620	9.978380	15	17
44	56	9.488424	10.511576	9.510054	10.489946	10.021630	9.978370	4	16
45	15	9.488522	10.511478	9.510162	10.489838	10.021640	9.978360	45	15
46	30	9.488619	10.511381	9.510269	10.489731	10.021650	9.978350	30	14
47	45	9.488717	10.511283	9.510377	10.489623	10.021661	9.978339	15	13
48	57	9.488814	10.511186	9.510485	10.489515	10.021671	9.978329	3	12
49	15	9.488912	10.511088	9.510593	10.489407	10.021681	9.978319	45	11
50	30	9.489009	10.510991	9.510700	10.489300	10.021691	9.978309	30	10
51	45	9.489107	10.510893	9.510808	10.489192	10.021701	9.978299	15	9
52	58	9.489204	10.510796	9.510916	10.489084	10.021712	9.978288	2	8
53	15	9.489301	10.510699	9.511023	10.488977	10.021722	9.978278	45	7
54	30	9.489399	10.510601	9.511131	10.488869	10.021732	9.978268	30	6
55	45	9.489496	10.510504	9.511238	10.488762	10.021742	9.978258	15	5
56	59	9.489593	10.510407	9.511346	10.488654	10.021753	9.978247	1	4
57	15	9.489691	10.510309	9.511454	10.488546	10.021763	9.978237	45	3
58	30	9.489788	10.510212	9.511561	10.488439	10.021773	9.978227	30	2
59	45	9.489885	10.510115	9.511669	10.488331	10.021783	9.978217	15	1
60	60	9.489982	10.510018	9.511776	10.488224	10.021794	9.978206	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 48 ^m .		LOG. SINES, &c.						72 deg.	

1 ^h 12 ^m .		LOG. SINES, &c. (t.)						18 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.489982	10.510018	9.511776	10.488224	10.021794	9.978206	60	60
1	15	9.490080	10.509920	9.511883	10.488117	10.021804	9.978196	45	59
2	30	9.490177	10.509823	9.511991	10.488009	10.021814	9.978186	30	58
3	45	9.490274	10.509726	9.512098	10.487902	10.021825	9.978175	15	57
4	1	9.490371	10.509629	9.512206	10.487794	10.021835	9.978165	59	56
5	15	9.490468	10.509532	9.512313	10.487687	10.021845	9.978155	45	55
6	30	9.490565	10.509435	9.512420	10.487580	10.021855	9.978145	30	54
7	45	9.490662	10.509338	9.512528	10.487472	10.021866	9.978134	15	53
8	2	9.490759	10.509241	5.512635	10.487365	10.021876	9.978124	58	52
9	15	9.490856	10.509144	9.512742	10.487258	10.021886	9.978114	45	51
10	30	9.490953	10.509047	9.512850	10.487150	10.021896	9.978104	30	50
11	45	9.491050	10.508950	9.512957	10.487043	10.021907	9.978093	15	49
12	3	9.491147	10.508853	9.513064	10.486936	10.021917	9.978083	57	48
13	15	9.491244	10.508756	9.513171	10.486829	10.021927	9.978073	45	47
14	30	9.491341	10.508659	9.513278	10.486722	10.021938	9.978062	30	46
15	45	9.491438	10.508562	9.513386	10.486614	10.021948	9.978052	15	45
16	4	9.491534	10.508466	9.513493	10.486507	10.021958	9.978042	56	44
17	15	9.491631	10.508369	9.513600	10.486400	10.021969	9.978031	45	43
18	30	9.491728	10.508272	9.513707	10.486293	10.021979	9.978021	30	42
19	45	9.491825	10.508175	9.513814	10.486186	10.021989	9.978011	15	41
20	5	9.491922	10.508078	9.513921	10.486079	10.021999	9.978001	55	40
21	15	9.492018	10.507982	9.514028	10.485972	10.022010	9.977990	45	39
22	30	9.492115	10.507885	9.514135	10.485865	10.022020	9.977980	30	38
23	45	9.492212	10.507788	9.514242	10.485758	10.022030	9.977970	15	37
24	6	9.492308	10.507692	9.514349	10.485651	10.022041	9.977959	54	36
25	15	9.492405	10.507595	9.514456	10.485544	10.022051	9.977949	45	35
26	30	9.492501	10.507499	9.514563	10.485437	10.022061	9.977939	30	34
27	45	9.492598	10.507402	9.514670	10.485330	10.022072	9.977928	15	33
28	7	9.492695	10.507305	9.514777	10.485223	10.022082	9.977918	53	32
29	15	9.492791	10.507209	9.514883	10.485117	10.022092	9.977908	45	31
30	30	9.492888	10.507112	9.514990	10.485010	10.022103	9.977897	30	30
31	45	9.492984	10.507016	9.515097	10.484903	10.022113	9.977887	15	29
32	8	9.493081	10.506919	9.515204	10.484796	10.022123	9.977877	52	28
33	15	9.493177	10.506823	9.515311	10.484689	10.022134	9.977866	45	27
34	30	9.493273	10.506727	9.515417	10.484583	10.022144	9.977856	30	26
35	45	9.493370	10.506630	9.515524	10.484476	10.022154	9.977846	15	25
36	9	9.493466	10.506534	9.515631	10.484369	10.022165	9.977835	51	24
37	15	9.493562	10.506438	9.515738	10.484262	10.022175	9.977825	45	23
38	30	9.493659	10.506341	9.515844	10.484156	10.022186	9.977814	30	22
39	45	9.493755	10.506245	9.515951	10.484049	10.022196	9.977804	15	21
40	10	9.493851	10.506149	9.516057	10.483943	10.022206	9.977794	50	20
41	15	9.493947	10.506053	9.516164	10.483836	10.022217	9.977783	45	19
42	30	9.494044	10.505956	9.516271	10.483729	10.022227	9.977773	30	18
43	45	9.494140	10.505860	9.516377	10.483623	10.022237	9.977763	15	17
44	11	9.494236	10.505764	9.516484	10.483516	10.022248	9.977752	49	16
45	15	9.494332	10.505668	9.516590	10.483410	10.022258	9.977742	45	15
46	30	9.494428	10.505572	9.516697	10.483303	10.022268	9.977732	30	14
47	45	9.494524	10.505476	9.516803	10.483197	10.022279	9.977721	15	13
48	12	9.494620	10.505380	9.516910	10.483090	10.022289	9.977711	48	12
49	15	9.494717	10.505283	9.517016	10.482984	10.022300	9.977700	45	11
50	30	9.494813	10.505187	9.517123	10.482877	10.022310	9.977690	30	10
51	45	9.494909	10.505091	9.517229	10.482771	10.022320	9.977680	15	9
52	13	9.495005	10.504995	9.517335	10.482665	10.022331	9.977669	47	8
53	15	9.495100	10.504900	9.517442	10.482558	10.022341	9.977659	45	7
54	30	9.495196	10.504804	9.517548	10.482452	10.022352	9.977648	30	6
55	45	9.495292	10.504708	9.517654	10.482346	10.022362	9.977638	15	5
56	14	9.495388	10.504612	9.517761	10.482239	10.022372	9.977628	46	4
57	15	9.495484	10.504516	9.517867	10.482133	10.022383	9.977617	45	3
58	30	9.495580	10.504420	9.517973	10.482027	10.022393	9.977607	30	2
59	45	9.495676	10.504324	9.518079	10.481921	10.022404	9.977596	15	1
60	15	9.495772	10.504228	9.518185	10.481815	10.022414	9.977586	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 47 ^m .		LOG. SINES, &c.						71 deg.	

1 ^h 13 ^m .		LOG. SINES, &c. (t.)						18 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.495772	10.504228	9.518185	10.481815	10.022414	9.977586	45	60
1	15	9.495867	10.504133	9.518292	10.481708	10.022424	9.977576	45	59
2	30	9.495963	10.504037	9.518398	10.481602	10.022435	9.977565	30	58
3	45	9.496059	10.503941	9.518504	10.481496	10.022445	9.977555	15	57
4	16	9.496154	10.503846	9.518610	10.481390	10.022456	9.977544	44	56
5	15	9.496250	10.503750	9.518716	10.481284	10.022466	9.977534	45	55
6	30	9.496346	10.503654	9.518822	10.481178	10.022477	9.977523	30	54
7	45	9.496441	10.503559	9.518928	10.481072	10.022487	9.977513	15	53
8	17	9.496537	10.503463	9.519034	10.480966	10.022497	9.977503	43	52
9	15	9.496633	10.503367	9.519140	10.480860	10.022508	9.977492	45	51
10	30	9.496728	10.503272	9.519246	10.480754	10.022518	9.977482	30	50
11	45	9.496824	10.503176	9.519352	10.480648	10.022529	9.977471	15	49
12	18	9.496919	10.503081	9.519458	10.480542	10.022539	9.977461	42	48
13	15	9.497015	10.502985	9.519564	10.480436	10.022550	9.977450	45	47
14	30	9.497110	10.502890	9.519670	10.480330	10.022560	9.977440	30	46
15	45	9.497206	10.502794	9.519776	10.480224	10.022571	9.977429	15	45
16	19	9.497301	10.502699	9.519882	10.480118	10.022581	9.977419	41	44
17	15	9.497396	10.502604	9.519988	10.480012	10.022591	9.977409	45	43
18	30	9.497492	10.502508	9.520094	10.479906	10.022602	9.977398	30	42
19	45	9.497587	10.502413	9.520199	10.479801	10.022612	9.977388	15	41
20	20	9.497682	10.502318	9.520305	10.479695	10.022623	9.977377	40	40
21	15	9.497778	10.502222	9.520411	10.479589	10.022633	9.977367	45	39
22	30	9.497873	10.502127	9.520517	10.479483	10.022644	9.977356	30	38
23	45	9.497968	10.502032	9.520622	10.479378	10.022654	9.977346	15	37
24	21	9.498063	10.501937	9.520728	10.479272	10.022665	9.977335	39	36
25	15	9.498159	10.501841	9.520834	10.479166	10.022675	9.977325	45	35
26	30	9.498254	10.501746	9.520939	10.479061	10.022686	9.977314	30	34
27	45	9.498349	10.501651	9.521045	10.478955	10.022696	9.977304	15	33
28	22	9.498444	10.501556	9.521151	10.478849	10.022707	9.977293	38	32
29	15	9.498539	10.501461	9.521256	10.478744	10.022717	9.977283	45	31
30	30	9.498634	10.501366	9.521362	10.478638	10.022728	9.977272	30	30
31	45	9.498729	10.501271	9.521467	10.478533	10.022738	9.977262	15	29
32	23	9.498824	10.501176	9.521573	10.478427	10.022749	9.977251	37	28
33	15	9.498919	10.501081	9.521679	10.478321	10.022759	9.977241	45	27
34	30	9.499014	10.500986	9.521784	10.478216	10.022770	9.977230	30	26
35	45	9.499109	10.500891	9.521889	10.478111	10.022780	9.977220	15	25
36	24	9.499204	10.500796	9.521995	10.478005	10.022791	9.977209	36	24
37	15	9.499299	10.500701	9.522100	10.477900	10.022801	9.977199	45	23
38	30	9.499394	10.500606	9.522206	10.477794	10.022812	9.977188	30	22
39	45	9.499489	10.500511	9.522311	10.477689	10.022822	9.977178	15	21
40	25	9.499584	10.500416	9.522417	10.477583	10.022833	9.977167	35	20
41	15	9.499679	10.500321	9.522522	10.477478	10.022843	9.977157	45	19
42	30	9.499774	10.500226	9.522627	10.477373	10.022854	9.977146	30	18
43	45	9.499868	10.500132	9.522733	10.477267	10.022864	9.977136	15	17
44	26	9.499963	10.500037	9.522838	10.477162	10.022875	9.977125	34	16
45	15	9.500058	10.499942	9.522943	10.477057	10.022885	9.977115	45	15
46	30	9.500153	10.499847	9.523048	10.476952	10.022896	9.977104	30	14
47	45	9.500247	10.499753	9.523154	10.476846	10.022906	9.977094	15	13
48	27	9.500342	10.499658	9.523259	10.476741	10.022917	9.977083	33	12
49	15	9.500437	10.499563	9.523364	10.476636	10.022927	9.977073	45	11
50	30	9.500531	10.499469	9.523469	10.476531	10.022938	9.977062	30	10
51	45	9.500626	10.499374	9.523574	10.476426	10.022948	9.977052	15	9
52	28	9.500721	10.499279	9.523679	10.476321	10.022959	9.977041	32	8
53	15	9.500815	10.499185	9.523785	10.476215	10.022970	9.977030	45	7
54	30	9.500910	10.499090	9.523890	10.476110	10.022980	9.977020	30	6
55	45	9.501004	10.498996	9.523995	10.476005	10.022991	9.977009	15	5
56	29	9.501099	10.498901	9.524100	10.475900	10.023001	9.976999	31	4
57	15	9.501193	10.498807	9.524205	10.475795	10.023012	9.976988	45	3
58	30	9.501288	10.498712	9.524310	10.475690	10.023022	9.976978	30	2
59	45	9.501382	10.498618	9.524415	10.475585	10.023033	9.976967	15	1
60	30	9.501476	10.498524	9.524520	10.475480	10.023043	9.976957	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 46 ^m .		LOG. SINES, &c.						71 deg.	

1 ^h 14 ^m .				LOG. SINES, &c. (t.)				18 deg.			
sec.	"	sine	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	30	9.501476	10.498524	9.524520	10.475480	10.023043	9.976957	30		60	
1	15	9.501571	10.498429	9.524625	10.475375	10.023054	9.976946	45		59	
2	30	9.501665	10.498335	9.524730	10.475270	10.023065	9.976935	30		58	
3	45	9.501759	10.498241	9.524835	10.475165	10.023075	9.976925	15		57	
4	31	9.501854	10.498146	9.524939	10.475061	10.023086	9.976914	29		56	
5	15	9.501948	10.498052	9.525044	10.474956	10.023096	9.976904	45		55	
6	30	9.502042	10.497958	9.525149	10.474851	10.023107	9.976893	30		54	
7	45	9.502137	10.497863	9.525254	10.474746	10.023118	9.976882	15		53	
8	32	9.502231	10.497769	9.525359	10.474641	10.023128	9.976872	28		52	
9	15	9.502325	10.497675	9.525464	10.474536	10.023139	9.976861	45		51	
10	30	9.502419	10.497581	9.525568	10.474432	10.023149	9.976851	30		50	
11	45	9.502513	10.497487	9.525673	10.474327	10.023160	9.976840	15		49	
12	33	9.502607	10.497393	9.525778	10.474222	10.023170	9.976830	27		48	
13	15	9.502702	10.497298	9.525883	10.474117	10.023181	9.976819	45		47	
14	30	9.502796	10.497204	9.525987	10.474013	10.023192	9.976808	30		46	
15	45	9.502890	10.497110	9.526092	10.473908	10.023202	9.976798	15		45	
16	34	9.502984	10.497016	9.526197	10.473803	10.023213	9.976787	26		44	
17	15	9.503078	10.496922	9.526301	10.473699	10.023223	9.976777	45		43	
18	30	9.503172	10.496828	9.526406	10.473594	10.023234	9.976766	30		42	
19	45	9.503266	10.496734	9.526510	10.473490	10.023245	9.976755	15		41	
20	35	9.503360	10.496640	9.526615	10.473385	10.023255	9.976745	25		40	
21	15	9.503454	10.496546	9.526719	10.473281	10.023266	9.976734	45		39	
22	30	9.503547	10.496453	9.526824	10.473176	10.023277	9.976723	30		38	
23	45	9.503641	10.496359	9.526929	10.473071	10.023287	9.976713	15		37	
24	36	9.503735	10.496265	9.527033	10.472967	10.023298	9.976702	24		36	
25	15	9.503829	10.496171	9.527137	10.472863	10.023308	9.976692	45		35	
26	30	9.503923	10.496077	9.527242	10.472758	10.023319	9.976681	30		34	
27	45	9.504017	10.495983	9.527346	10.472654	10.023330	9.976670	15		33	
28	37	9.504110	10.495890	9.527451	10.472549	10.023340	9.976660	23		32	
29	15	9.504204	10.495796	9.527555	10.472445	10.023351	9.976649	45		31	
30	30	9.504298	10.495702	9.527659	10.472341	10.023362	9.976638	30		30	
31	45	9.504392	10.495608	9.527764	10.472236	10.023372	9.976628	15		29	
32	38	9.504485	10.495515	9.527868	10.472132	10.023383	9.976617	22		28	
33	15	9.504579	10.495421	9.527972	10.472028	10.023394	9.976606	45		27	
34	30	9.504673	10.495327	9.528077	10.471923	10.023404	9.976596	30		26	
35	45	9.504766	10.495234	9.528181	10.471819	10.023415	9.976585	15		25	
36	39	9.504860	10.495140	9.528285	10.471715	10.023426	9.976574	21		24	
37	15	9.504953	10.495047	9.528389	10.471611	10.023436	9.976564	45		23	
38	30	9.505047	10.494953	9.528494	10.471506	10.023447	9.976553	30		22	
39	45	9.505140	10.494860	9.528598	10.471402	10.023458	9.976542	15		21	
40	40	9.505234	10.494766	9.528702	10.471298	10.023468	9.976532	20		20	
41	15	9.505327	10.494673	9.528806	10.471194	10.023479	9.976521	45		19	
42	30	9.505421	10.494579	9.528910	10.471090	10.023490	9.976510	30		18	
43	45	9.505514	10.494486	9.529014	10.470986	10.023500	9.976500	15		17	
44	41	9.505608	10.494392	9.529119	10.470881	10.023511	9.976489	19		16	
45	15	9.505701	10.494299	9.529223	10.470777	10.023522	9.976478	45		15	
46	30	9.505794	10.494206	9.529327	10.470673	10.023532	9.976468	30		14	
47	45	9.505888	10.494112	9.529431	10.470569	10.023543	9.976457	15		13	
48	42	9.505981	10.494019	9.529535	10.470465	10.023554	9.976446	18		12	
49	15	9.506074	10.493926	9.529639	10.470361	10.023564	9.976436	45		11	
50	30	9.506168	10.493832	9.529743	10.470257	10.023575	9.976425	30		10	
51	45	9.506261	10.493739	9.529847	10.470153	10.023586	9.976414	15		9	
52	43	9.506354	10.493646	9.529950	10.470050	10.023596	9.976404	17		8	
53	15	9.506447	10.493553	9.530054	10.469946	10.023607	9.976393	45		7	
54	30	9.506541	10.493459	9.530158	10.469842	10.023618	9.976382	30		6	
55	45	9.506634	10.493366	9.530262	10.469738	10.023629	9.976371	15		5	
56	44	9.506727	10.493273	9.530366	10.469634	10.023639	9.976361	16		4	
57	15	9.506820	10.493180	9.530470	10.469530	10.023650	9.976350	45		3	
58	30	9.506913	10.493087	9.530574	10.469426	10.023661	9.976339	30		2	
59	45	9.507006	10.492994	9.530677	10.469323	10.023671	9.976329	15		1	
60	45	9.507099	10.492901	9.530781	10.469219	10.023682	9.976318	15		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
1 ^h 45 ^m .				LOG. SINES, &c.				71 deg.			

1 ^h 15 ^m .		LOG. SINES, &c. (t.)						18 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.507099	10.492901	9.530781	10.469219	10.023682	9.976318	15	60
1	15	9.507192	10.492808	9.530885	10.469115	10.023693	9.976307	45	59
2	30	9.507285	10.492715	9.530989	10.469011	10.023704	9.976296	30	58
3	45	9.507378	10.492622	9.531092	10.468908	10.023714	9.976286	15	57
4	46	9.507471	10.492529	9.531196	10.468804	10.023725	9.976275	14	56
5	15	9.507564	10.492436	9.531300	10.468700	10.023736	9.976264	45	55
6	30	9.507657	10.492343	9.531403	10.468597	10.023746	9.976254	30	54
7	45	9.507750	10.492250	9.531507	10.468493	10.023757	9.976243	15	53
8	47	9.507843	10.492157	9.531611	10.468389	10.023768	9.976232	13	52
9	15	9.507936	10.492064	9.531714	10.468286	10.023779	9.976221	45	51
10	30	9.508028	10.491972	9.531818	10.468182	10.023789	9.976211	30	50
11	45	9.508121	10.491879	9.531921	10.468079	10.023800	9.976200	15	49
12	48	9.508214	10.491786	9.532025	10.467975	10.023811	9.976189	12	48
13	15	9.508307	10.491693	9.532128	10.467872	10.023822	9.976178	45	47
14	30	9.508400	10.491600	9.532232	10.467768	10.023832	9.976168	30	46
15	45	9.508492	10.491508	9.532335	10.467665	10.023843	9.976157	15	45
16	49	9.508585	10.491415	9.532439	10.467561	10.023854	9.976146	11	44
17	15	9.508678	10.491322	9.532542	10.467458	10.023865	9.976135	45	43
18	30	9.508770	10.491230	9.532646	10.467354	10.023876	9.976124	30	42
19	45	9.508863	10.491137	9.532749	10.467251	10.023886	9.976114	15	41
20	50	9.508956	10.491044	9.532853	10.467147	10.023897	9.976103	10	40
21	15	9.509048	10.490952	9.532956	10.467044	10.023908	9.976092	45	39
22	30	9.509141	10.490859	9.533059	10.466941	10.023919	9.976081	30	38
23	45	9.509233	10.490767	9.533163	10.466837	10.023929	9.976071	15	37
24	51	9.509326	10.490674	9.533266	10.466734	10.023940	9.976060	9	36
25	15	9.509418	10.490582	9.533369	10.466631	10.023951	9.976049	45	35
26	30	9.509511	10.490489	9.533472	10.466528	10.023962	9.976038	30	34
27	45	9.509603	10.490397	9.533576	10.466424	10.023973	9.976027	15	33
28	52	9.509696	10.490304	9.533679	10.466321	10.023983	9.976017	8	32
29	15	9.509788	10.490212	9.533782	10.466218	10.023994	9.976006	45	31
30	30	9.509880	10.490120	9.533885	10.466115	10.024005	9.975995	30	30
31	45	9.509973	10.490027	9.533988	10.466012	10.024016	9.975984	15	29
32	53	9.510065	10.489935	9.534092	10.465908	10.024026	9.975974	7	28
33	15	9.510157	10.489843	9.534195	10.465805	10.024037	9.975963	45	27
34	30	9.510250	10.489750	9.534298	10.465702	10.024048	9.975952	30	26
35	45	9.510342	10.489658	9.534401	10.465599	10.024059	9.975941	15	25
36	54	9.510434	10.489566	9.534504	10.465496	10.024070	9.975930	6	24
37	15	9.510526	10.489474	9.534607	10.465393	10.024081	9.975919	45	23
38	30	9.510619	10.489381	9.534710	10.465290	10.024091	9.975909	30	22
39	45	9.510711	10.489289	9.534813	10.465187	10.024102	9.975898	15	21
40	55	9.510803	10.489197	9.534916	10.465084	10.024113	9.975887	5	20
41	15	9.510895	10.489105	9.535019	10.464981	10.024124	9.975876	45	19
42	30	9.510987	10.489013	9.535122	10.464878	10.024135	9.975865	30	18
43	45	9.511079	10.488921	9.535225	10.464775	10.024145	9.975855	15	17
44	56	9.511172	10.488828	9.535328	10.464672	10.024156	9.975844	4	16
45	15	9.511264	10.488736	9.535431	10.464569	10.024167	9.975833	45	15
46	30	9.511356	10.488644	9.535534	10.464466	10.024178	9.975822	30	14
47	45	9.511448	10.488552	9.535636	10.464364	10.024189	9.975811	15	13
48	57	9.511540	10.488460	9.535739	10.464261	10.024200	9.975800	3	12
49	15	9.511632	10.488368	9.535842	10.464158	10.024211	9.975789	45	11
50	30	9.511724	10.488276	9.535945	10.464055	10.024221	9.975779	30	10
51	45	9.511815	10.488185	9.536048	10.463952	10.024232	9.975768	15	9
52	58	9.511907	10.488093	9.536150	10.463850	10.024243	9.975757	2	8
53	15	9.511999	10.488001	9.536253	10.463747	10.024254	9.975746	45	7
54	30	9.512091	10.487909	9.536356	10.463644	10.024265	9.975735	30	6
55	45	9.512183	10.487817	9.536459	10.463541	10.024276	9.975724	15	5
56	59	9.512275	10.487725	9.536561	10.463439	10.024287	9.975713	1	4
57	15	9.512367	10.487633	9.536664	10.463336	10.024297	9.975703	45	3
58	30	9.512458	10.487542	9.536767	10.463233	10.024308	9.975692	30	2
59	45	9.512550	10.487450	9.536869	10.463131	10.024319	9.975681	15	1
60	60	9.512642	10.487358	9.536972	10.463028	10.024330	9.975670	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 44 ^m .		LOG. SINES, &c.						71 deg.	

1 ^h 16 ^m .		LOG. SINES, &c. (t.)						19 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.512642	10.487358	9.536972	10.463028	10.024330	9.975670	60	60
1	15	9.512734	10.487266	9.537074	10.462926	10.024341	9.975659	45	59
2	30	9.512825	10.487175	9.537177	10.462823	10.024352	9.975648	30	58
3	45	9.512917	10.487083	9.537280	10.462720	10.024363	9.975637	15	57
4	1	9.513009	10.486991	9.537382	10.462618	10.024374	9.975626	59	56
5	15	9.513100	10.486900	9.537485	10.462515	10.024384	9.975616	45	55
6	30	9.513192	10.486808	9.537587	10.462413	10.024395	9.975605	30	54
7	45	9.513283	10.486717	9.537690	10.462310	10.024406	9.975594	15	53
8	2	9.513375	10.486625	9.537792	10.462208	10.024417	9.975583	58	52
9	15	9.513466	10.486534	9.537894	10.462106	10.024428	9.975572	45	51
10	30	9.513558	10.486442	9.537997	10.462003	10.024439	9.975561	30	50
11	45	9.513650	10.486350	9.538099	10.461901	10.024450	9.975550	15	49
12	3	9.513741	10.486259	9.538202	10.461798	10.024461	9.975539	57	48
13	15	9.513832	10.486168	9.538304	10.461696	10.024472	9.975528	45	47
14	30	9.513924	10.486076	9.538406	10.461594	10.024482	9.975518	30	46
15	45	9.514015	10.485985	9.538509	10.461491	10.024493	9.975507	15	45
16	4	9.514107	10.485893	9.538611	10.461389	10.024504	9.975496	56	44
17	15	9.514198	10.485802	9.538713	10.461287	10.024515	9.975485	45	43
18	30	9.514289	10.485711	9.538815	10.461185	10.024526	9.975474	30	42
19	45	9.514381	10.485619	9.538918	10.461082	10.024537	9.975463	15	41
20	5	9.514472	10.485528	9.539020	10.460980	10.024548	9.975452	55	40
21	15	9.514563	10.485437	9.539122	10.460878	10.024559	9.975441	45	39
22	30	9.514655	10.485345	9.539224	10.460776	10.024570	9.975430	30	38
23	45	9.514746	10.485254	9.539327	10.460673	10.024581	9.975419	15	37
24	6	9.514837	10.485163	9.539429	10.460571	10.024592	9.975408	54	36
25	15	9.514928	10.485072	9.539531	10.460469	10.024603	9.975397	45	35
26	30	9.515019	10.484981	9.539633	10.460367	10.024614	9.975386	30	34
27	45	9.515111	10.484889	9.539735	10.460265	10.024625	9.975375	15	33
28	7	9.515202	10.484798	9.539837	10.460163	10.024635	9.975365	53	32
29	15	9.515293	10.484707	9.539939	10.460061	10.024646	9.975354	45	31
30	30	9.515384	10.484616	9.540041	10.459959	10.024657	9.975343	30	30
31	45	9.515475	10.484525	9.540143	10.459857	10.024668	9.975332	15	29
32	8	9.515566	10.484434	9.540245	10.459755	10.024679	9.975321	52	28
33	15	9.515657	10.484343	9.540347	10.459653	10.024690	9.975310	45	27
34	30	9.515748	10.484252	9.540449	10.459551	10.024701	9.975299	30	26
35	45	9.515839	10.484161	9.540551	10.459449	10.024712	9.975288	15	25
36	9	9.515930	10.484070	9.540653	10.459347	10.024723	9.975277	51	24
37	15	9.516021	10.483979	9.540755	10.459245	10.024734	9.975266	45	23
38	30	9.516112	10.483888	9.540857	10.459143	10.024745	9.975255	30	22
39	45	9.516203	10.483797	9.540959	10.459041	10.024756	9.975244	15	21
40	10	9.516294	10.483706	9.541061	10.458939	10.024767	9.975233	50	20
41	15	9.516384	10.483616	9.541162	10.458838	10.024778	9.975222	45	19
42	30	9.516475	10.483525	9.541264	10.458736	10.024789	9.975211	30	18
43	45	9.516566	10.483434	9.541366	10.458634	10.024800	9.975200	15	17
44	11	9.516657	10.483343	9.541468	10.458532	10.024811	9.975189	49	16
45	15	9.516748	10.483252	9.541570	10.458430	10.024822	9.975178	45	15
46	30	9.516838	10.483162	9.541671	10.458329	10.024833	9.975167	30	14
47	45	9.516929	10.483071	9.541773	10.458227	10.024844	9.975156	15	13
48	12	9.517020	10.482980	9.541875	10.458125	10.024855	9.975145	48	12
49	15	9.517110	10.482890	9.541976	10.458024	10.024866	9.975134	45	11
50	30	9.517201	10.482799	9.542078	10.457922	10.024877	9.975123	30	10
51	45	9.517292	10.482708	9.542180	10.457820	10.024888	9.975112	15	9
52	13	9.517382	10.482618	9.542281	10.457719	10.024899	9.975101	47	8
53	15	9.517473	10.482527	9.542383	10.457617	10.024910	9.975090	45	7
54	30	9.517564	10.482436	9.542484	10.457516	10.024921	9.975079	30	6
55	45	9.517654	10.482346	9.542586	10.457414	10.024932	9.975068	15	5
56	14	9.517745	10.482255	9.542688	10.457312	10.024943	9.975057	46	4
57	15	9.517835	10.482165	9.542789	10.457211	10.024954	9.975046	45	3
58	30	9.517926	10.482074	9.542891	10.457109	10.024965	9.975035	30	2
59	45	9.518016	10.481984	9.542992	10.457008	10.024976	9.975024	15	1
60	15	9.518107	10.481893	9.543094	10.456906	10.024987	9.975013	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 43 ^m .		LOG. SINES, &c.						70 deg.	

1 ^h 17 ^m .		LOG. SINES, &c. (t.)						19 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	15	9.518107	10.481893	9.543094	10.456906	10.024987	9.975013	45		60
1	15	9.518197	10.481803	9.543195	10.456805	10.024998	9.975002	45	59	
2	30	9.518287	10.481713	9.543297	10.456703	10.025009	9.974991	30	58	
3	45	9.518378	10.481622	9.543398	10.456602	10.025020	9.974980	15	57	
4	16	9.518468	10.481532	9.543499	10.456501	10.025031	9.974969	44	56	
5	15	9.518559	10.481441	9.543601	10.456399	10.025042	9.974958	45	55	
6	30	9.518649	10.481351	9.543702	10.456298	10.025053	9.974947	30	54	
7	45	9.518739	10.481261	9.543803	10.456197	10.025064	9.974936	15	53	
8	17	9.518829	10.481171	9.543905	10.456095	10.025075	9.974925	43	52	
9	15	9.518920	10.481080	9.544006	10.455994	10.025086	9.974914	45	51	
10	30	9.519010	10.480990	9.544107	10.455893	10.025098	9.974902	30	50	
11	45	9.519100	10.480900	9.544209	10.455791	10.025109	9.974891	15	49	
12	18	9.519190	10.480810	9.544310	10.455690	10.025120	9.974880	42	48	
13	15	9.519281	10.480719	9.544411	10.455589	10.025131	9.974869	45	47	
14	30	9.519371	10.480629	9.544512	10.455488	10.025142	9.974858	30	46	
15	45	9.519461	10.480539	9.544614	10.455386	10.025153	9.974847	15	45	
16	19	9.519551	10.480449	9.544715	10.455285	10.025164	9.974836	41	44	
17	15	9.519641	10.480359	9.544816	10.455184	10.025175	9.974825	45	43	
18	30	9.519731	10.480269	9.544917	10.455083	10.025186	9.974814	30	42	
19	45	9.519821	10.480179	9.545018	10.454982	10.025197	9.974803	15	41	
20	20	9.519911	10.480089	9.545119	10.454881	10.025208	9.974792	40	40	
21	15	9.520001	10.479999	9.545220	10.454780	10.025219	9.974781	45	39	
22	30	9.520091	10.479909	9.545321	10.454679	10.025230	9.974770	30	38	
23	45	9.520181	10.479819	9.545423	10.454577	10.025241	9.974759	15	37	
24	21	9.520271	10.479729	9.545524	10.454476	10.025253	9.974747	39	36	
25	15	9.520361	10.479639	9.545625	10.454375	10.025264	9.974736	45	35	
26	30	9.520451	10.479549	9.545726	10.454274	10.025275	9.974725	30	34	
27	45	9.520541	10.479459	9.545827	10.454173	10.025286	9.974714	15	33	
28	22	9.520631	10.479369	9.545928	10.454072	10.025297	9.974703	38	32	
29	15	9.520720	10.479280	9.546028	10.453972	10.025308	9.974692	45	31	
30	30	9.520810	10.479190	9.546129	10.453871	10.025319	9.974681	30	30	
31	45	9.520900	10.479100	9.546230	10.453770	10.025330	9.974670	15	29	
32	23	9.520990	10.479010	9.546331	10.453669	10.025341	9.974659	37	28	
33	15	9.521080	10.478920	9.546432	10.453568	10.025352	9.974648	45	27	
34	30	9.521169	10.478831	9.546533	10.453467	10.025364	9.974636	30	26	
35	45	9.521259	10.478741	9.546634	10.453366	10.025375	9.974625	15	25	
36	24	9.521349	10.478651	9.546735	10.453265	10.025386	9.974614	36	24	
37	15	9.521438	10.478562	9.546835	10.453165	10.025397	9.974603	45	23	
38	30	9.521528	10.478472	9.546936	10.453064	10.025408	9.974592	30	22	
39	45	9.521618	10.478382	9.547037	10.452963	10.025419	9.974581	15	21	
40	25	9.521707	10.478293	9.547138	10.452862	10.025430	9.974570	35	20	
41	15	9.521797	10.478203	9.547238	10.452762	10.025441	9.974559	45	19	
42	30	9.521886	10.478114	9.547339	10.452661	10.025453	9.974547	30	18	
43	45	9.521976	10.478024	9.547440	10.452560	10.025464	9.974536	15	17	
44	26	9.522066	10.477934	9.547540	10.452460	10.025475	9.974525	34	16	
45	15	9.522155	10.477845	9.547641	10.452359	10.025486	9.974514	45	15	
46	30	9.522245	10.477755	9.547742	10.452258	10.025497	9.974503	30	14	
47	45	9.522334	10.477666	9.547842	10.452158	10.025508	9.974492	15	13	
48	27	9.522424	10.477577	9.547943	10.452057	10.025519	9.974481	33	12	
49	15	9.522513	10.477487	9.548043	10.451957	10.025531	9.974469	45	11	
50	30	9.522602	10.477398	9.548144	10.451856	10.025542	9.974458	30	10	
51	45	9.522692	10.477308	9.548245	10.451755	10.025553	9.974447	15	9	
52	28	9.522781	10.477219	9.548345	10.451655	10.025564	9.974436	32	8	
53	15	9.522870	10.477130	9.548446	10.451554	10.025575	9.974425	45	7	
54	30	9.522960	10.477040	9.548546	10.451454	10.025586	9.974414	30	6	
55	45	9.523049	10.476951	9.548647	10.451353	10.025598	9.974402	15	5	
56	29	9.523138	10.476862	9.548747	10.451253	10.025609	9.974391	31	4	
57	15	9.523228	10.476772	9.548847	10.451153	10.025620	9.974380	45	3	
58	30	9.523317	10.476683	9.548948	10.451052	10.025631	9.974369	30	2	
59	45	9.523406	10.476594	9.549048	10.450952	10.025642	9.974358	15	1	
60	30	9.523495	10.476505	9.549149	10.450851	10.025653	9.974347	30	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.

4^h 42^m.

LOG. SINES, &c.

70 deg.

1 ^h 18 ^m .			LOG. SINES, &c. (t.)				19 deg.			
sec.	'	"	sine.	cosecant	tangent	cotangent.	secant.	cosine.	'	sec.
0	30		9.523495	10.476505	9.549149	10.450851	10.025653	9.974347	30	60
1		15	9.523584	10.476416	9.549249	10.450751	10.025665	9.974335	45	59
2		30	9.523674	10.476326	9.549349	10.450651	10.025676	9.974324	30	58
3		45	9.523763	10.476237	9.549450	10.450550	10.025687	9.974313	15	57
4	31		9.523852	10.476148	9.549550	10.450450	10.025698	9.974302		56
5		15	9.523941	10.476059	9.549650	10.450350	10.025709	9.974291	45	55
6		30	9.524030	10.475970	9.549751	10.450249	10.025721	9.974279	30	54
7		45	9.524119	10.475881	9.549851	10.450149	10.025732	9.974268	15	53
8	32		9.524208	10.475792	9.549951	10.450049	10.025743	9.974257		52
9		15	9.524297	10.475703	9.550051	10.449949	10.025754	9.974246	45	51
10		30	9.524386	10.475614	9.550151	10.449849	10.025765	9.974235	30	50
11		45	9.524475	10.475525	9.550252	10.449748	10.025777	9.974223	15	49
12	33		9.524564	10.475436	9.550352	10.449648	10.025788	9.974212		48
13		15	9.524653	10.475347	9.550452	10.449548	10.025799	9.974201	45	47
14		30	9.524742	10.475258	9.550552	10.449448	10.025810	9.974190	30	46
15		45	9.524831	10.475169	9.550652	10.449348	10.025822	9.974178	15	45
16	34		9.524920	10.475080	9.550752	10.449248	10.025833	9.974167		44
17		15	9.525008	10.474992	9.550852	10.449148	10.025844	9.974156	45	43
18		30	9.525097	10.474903	9.550952	10.449048	10.025855	9.974145	30	42
19		45	9.525186	10.474814	9.551052	10.448948	10.025866	9.974134	15	41
20	35		9.525275	10.474725	9.551152	10.448848	10.025878	9.974122		40
21		15	9.525364	10.474636	9.551252	10.448748	10.025889	9.974111	45	39
22		30	9.525452	10.474548	9.551352	10.448648	10.025900	9.974100	30	38
23		45	9.525541	10.474459	9.551452	10.448548	10.025911	9.974089	15	37
24	36		9.525630	10.474370	9.551552	10.448448	10.025923	9.974077		36
25		15	9.525718	10.474282	9.551652	10.448348	10.025934	9.974066	45	35
26		30	9.525807	10.474193	9.551752	10.448248	10.025945	9.974055	30	34
27		45	9.525896	10.474104	9.551852	10.448148	10.025956	9.974044	15	33
28	37		9.525984	10.474016	9.551952	10.448048	10.025968	9.974032		32
29		15	9.526073	10.473927	9.552052	10.447948	10.025979	9.974021	45	31
30		30	9.526162	10.473838	9.552152	10.447848	10.025990	9.974010	30	30
31		45	9.526250	10.473750	9.552252	10.447748	10.026001	9.973999	15	29
32	38		9.526339	10.473661	9.552351	10.447649	10.026013	9.973987		28
33		15	9.526427	10.473573	9.552451	10.447549	10.026024	9.973976	45	27
34		30	9.526516	10.473484	9.552551	10.447449	10.026035	9.973965	30	26
35		45	9.526604	10.473396	9.552651	10.447349	10.026047	9.973953	15	25
36	39		9.526693	10.473307	9.552750	10.447250	10.026058	9.973942		24
37		15	9.526781	10.473219	9.552850	10.447150	10.026069	9.973931	45	23
38		30	9.526870	10.473130	9.552950	10.447050	10.026080	9.973920	30	22
39		45	9.526958	10.473042	9.553050	10.446950	10.026092	9.973908	15	21
40	40		9.527046	10.472954	9.553149	10.446851	10.026103	9.973897		20
41		15	9.527135	10.472865	9.553249	10.446751	10.026114	9.973886	45	19
42		30	9.527223	10.472777	9.553348	10.446652	10.026126	9.973874	30	18
43		45	9.527311	10.472689	9.553448	10.446552	10.026137	9.973863	15	17
44	41		9.527400	10.472600	9.553548	10.446452	10.026148	9.973852		16
45		15	9.527488	10.472512	9.553647	10.446353	10.026159	9.973841	45	15
46		30	9.527576	10.472424	9.553747	10.446253	10.026171	9.973829	30	14
47		45	9.527664	10.472336	9.553846	10.446154	10.026182	9.973818	15	13
48	42		9.527753	10.472247	9.553946	10.446054	10.026193	9.973807		12
49		15	9.527841	10.472159	9.554045	10.445955	10.026205	9.973795	45	11
50		30	9.527929	10.472071	9.554145	10.445855	10.026216	9.973784	30	10
51		45	9.528017	10.471983	9.554244	10.445756	10.026227	9.973773	15	9
52	43		9.528105	10.471895	9.554344	10.445656	10.026239	9.973761		8
53		15	9.528193	10.471807	9.554443	10.445557	10.026250	9.973750	45	7
54		30	9.528281	10.471719	9.554543	10.445457	10.026261	9.973739	30	6
55		45	9.528370	10.471630	9.554642	10.445358	10.026273	9.973727	15	5
56	44		9.528458	10.471542	9.554741	10.445259	10.026284	9.973716		4
57		15	9.528546	10.471454	9.554841	10.445159	10.026295	9.973705	45	3
58		30	9.528634	10.471366	9.554940	10.445060	10.026307	9.973693	30	2
59		45	9.528722	10.471278	9.555039	10.444961	10.026318	9.973682	15	1
60	45		9.528810	10.471190	9.555139	10.444861	10.026329	9.973671		0
			cosine.	secant.	cotangent.	tangent.	cosecant.	sine.		sec.
4 ^h 41 ^m .			LOG. SINES, &c.				70 deg.			

1 ^h 19 ^m .		LOG. SINES, &c. (t.)						19 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine	"	sec.
0	45	9.528810	10.471190	9.555139	10.444861	10.026329	9.973671	15	60
1	15	9.528898	10.471102	9.555238	10.444762	10.026341	9.973659	45	59
2	30	9.528986	10.471014	9.555337	10.444663	10.026352	9.973648	30	58
3	45	9.529073	10.470927	9.555437	10.444563	10.026363	9.973637	15	57
4	46	9.529161	10.470839	9.555536	10.444464	10.026375	9.973625	14	56
5	15	9.529249	10.470751	9.555635	10.444365	10.026386	9.973614	45	55
6	30	9.529337	10.470663	9.555734	10.444266	10.026397	9.973603	30	54
7	45	9.529425	10.470575	9.555833	10.444167	10.026409	9.973591	15	53
8	47	9.529513	10.470487	9.555933	10.444067	10.026420	9.973580	13	52
9	15	9.529601	10.470399	9.556032	10.443968	10.026431	9.973569	45	51
10	30	9.529688	10.470312	9.556131	10.443869	10.026443	9.973557	30	50
11	45	9.529776	10.470224	9.556230	10.443770	10.026454	9.973546	15	49
12	48	9.529864	10.470136	9.556329	10.443671	10.026465	9.973535	12	48
13	15	9.529951	10.470049	9.556428	10.443572	10.026477	9.973523	45	47
14	30	9.530039	10.469961	9.556527	10.443473	10.026488	9.973512	30	46
15	45	9.530127	10.469873	9.556626	10.443374	10.026500	9.973500	15	45
16	49	9.530215	10.469785	9.556725	10.443275	10.026511	9.973489	11	44
17	15	9.530302	10.469698	9.556824	10.443176	10.026522	9.973478	45	43
18	30	9.530390	10.469610	9.556923	10.443077	10.026534	9.973466	30	42
19	45	9.530477	10.469523	9.557022	10.442978	10.026545	9.973455	15	41
20	50	9.530565	10.469435	9.557121	10.442879	10.026557	9.973443	10	40
21	15	9.530652	10.469348	9.557220	10.442780	10.026568	9.973432	45	39
22	30	9.530740	10.469260	9.557319	10.442681	10.026579	9.973421	30	38
23	45	9.530828	10.469172	9.557418	10.442582	10.026591	9.973409	15	37
24	51	9.530915	10.469085	9.557517	10.442483	10.026602	9.973398	9	36
25	15	9.531002	10.468998	9.557616	10.442384	10.026613	9.973387	45	35
26	30	9.531090	10.468910	9.557715	10.442285	10.026625	9.973375	30	34
27	45	9.531177	10.468823	9.557814	10.442186	10.026636	9.973364	15	33
28	52	9.531265	10.468735	9.557912	10.442088	10.026648	9.973352	8	32
29	15	9.531352	10.468648	9.558011	10.441989	10.026659	9.973341	45	31
30	30	9.531440	10.468560	9.558110	10.441890	10.026671	9.973329	30	30
31	45	9.531527	10.468473	9.558209	10.441791	10.026682	9.973318	15	29
32	53	9.531614	10.468386	9.558308	10.441692	10.026693	9.973307	7	28
33	15	9.531702	10.468298	9.558406	10.441594	10.026705	9.973295	45	27
34	30	9.531789	10.468211	9.558505	10.441495	10.026716	9.973284	30	26
35	45	9.531876	10.468124	9.558604	10.441396	10.026728	9.973272	15	25
36	54	9.531963	10.468037	9.558702	10.441298	10.026739	9.973261	6	24
37	15	9.532051	10.467949	9.558801	10.441199	10.026751	9.973249	45	23
38	30	9.532138	10.467862	9.558900	10.441100	10.026762	9.973238	30	22
39	45	9.532225	10.467775	9.558998	10.441002	10.026773	9.973227	15	21
40	55	9.532312	10.467688	9.559097	10.440903	10.026785	9.973215	5	20
41	15	9.532399	10.467601	9.559196	10.440804	10.026796	9.973204	45	19
42	30	9.532487	10.467513	9.559294	10.440706	10.026808	9.973192	30	18
43	45	9.532574	10.467426	9.559393	10.440607	10.026819	9.973181	15	17
44	56	9.532661	10.467339	9.559491	10.440509	10.026831	9.973169	4	16
45	15	9.532748	10.467252	9.559590	10.440410	10.026842	9.973158	45	15
46	30	9.532835	10.467165	9.559688	10.440312	10.026854	9.973146	30	14
47	45	9.532922	10.467078	9.559787	10.440213	10.026865	9.973135	15	13
48	57	9.533009	10.466991	9.559885	10.440115	10.026876	9.973124	3	12
49	15	9.533096	10.466904	9.559984	10.440016	10.026888	9.973112	45	11
50	30	9.533183	10.466817	9.560082	10.439918	10.026899	9.973101	30	10
51	45	9.533270	10.466730	9.560181	10.439819	10.026911	9.973089	15	9
52	58	9.533357	10.466643	9.560279	10.439721	10.026922	9.973078	2	8
53	15	9.533444	10.466556	9.560378	10.439622	10.026934	9.973066	45	7
54	30	9.533531	10.466469	9.560476	10.439524	10.026945	9.973055	30	6
55	45	9.533618	10.466382	9.560574	10.439426	10.026957	9.973043	15	5
56	59	9.533704	10.466296	9.560673	10.439327	10.026968	9.973032	1	4
57	15	9.533791	10.466209	9.560771	10.439229	10.026980	9.973020	45	3
58	30	9.533878	10.466122	9.560869	10.439131	10.026991	9.973009	30	2
59	45	9.533965	10.466035	9.560968	10.439032	10.027003	9.972997	15	1
60	60	9.534052	10.465948	9.561066	10.438934	10.027014	9.972986	(0)	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 40 ^m		LOG. SINES, &c.						70 deg.	

1 ^h 20 ^m		LOG. SINES, &c. (t.)						20 deg.	
sec.	"	sine.	cosecant	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.534052	10.465948	9.561066	10.438934	10.027014	9.972986	60	60
1	15	9.534138	10.465862	9.561164	10.438836	10.027026	9.972974	45	59
2	30	9.534225	10.465775	9.561262	10.438738	10.027037	9.972963	30	58
3	45	9.534312	10.465688	9.561361	10.438639	10.027049	9.972951	15	57
4	1	9.534399	10.465601	9.561459	10.438541	10.027060	9.972940	59	56
5	15	9.534485	10.465515	9.561557	10.438443	10.027072	9.972928	45	55
6	30	9.534572	10.465428	9.561655	10.438345	10.027083	9.972917	30	54
7	45	9.534659	10.465341	9.561753	10.438247	10.027095	9.972905	15	53
8	2	9.534745	10.465255	9.561851	10.438149	10.027106	9.972894	58	52
9	15	9.534832	10.465168	9.561950	10.438050	10.027118	9.972882	45	51
10	30	9.534918	10.465082	9.562048	10.437952	10.027129	9.972871	30	50
11	45	9.535005	10.464995	9.562146	10.437854	10.027141	9.972859	15	49
12	3	9.535091	10.464909	9.562244	10.437756	10.027152	9.972848	57	48
13	15	9.535178	10.464822	9.562342	10.437658	10.027164	9.972836	45	47
14	30	9.535265	10.464735	9.562440	10.437560	10.027175	9.972825	30	46
15	45	9.535351	10.464649	9.562538	10.437462	10.027187	9.972813	15	45
16	4	9.535437	10.464563	9.562636	10.437364	10.027198	9.972802	56	44
17	15	9.535524	10.464476	9.562734	10.437266	10.027210	9.972790	45	43
18	30	9.535610	10.464390	9.562832	10.437168	10.027222	9.972778	30	42
19	45	9.535697	10.464303	9.562930	10.437070	10.027233	9.972767	15	41
20	5	9.535783	10.464217	9.563028	10.436972	10.027245	9.972755	55	40
21	15	9.535870	10.464130	9.563126	10.436874	10.027256	9.972744	45	39
22	30	9.535956	10.464044	9.563224	10.436776	10.027268	9.972732	30	38
23	45	9.536042	10.463958	9.563321	10.436679	10.027279	9.972721	15	37
24	6	9.536129	10.463871	9.563419	10.436581	10.027291	9.972709	54	36
25	15	9.536215	10.463785	9.563517	10.436483	10.027302	9.972698	45	35
26	30	9.536301	10.463699	9.563615	10.436385	10.027314	9.972686	30	34
27	45	9.536387	10.463613	9.563713	10.436287	10.027326	9.972674	15	33
28	7	9.536474	10.463526	9.563811	10.436189	10.027337	9.972663	53	32
29	15	9.536560	10.463440	9.563908	10.436092	10.027349	9.972651	45	31
30	30	9.536646	10.463354	9.564006	10.435994	10.027360	9.972640	30	30
31	45	9.536732	10.463268	9.564104	10.435896	10.027372	9.972628	15	29
32	8	9.536818	10.463182	9.564202	10.435798	10.027383	9.972617	52	28
33	15	9.536904	10.463096	9.564299	10.435701	10.027395	9.972605	45	27
34	30	9.536991	10.463009	9.564397	10.435603	10.027407	9.972593	30	26
35	45	9.537077	10.462923	9.564495	10.435505	10.027418	9.972582	15	25
36	9	9.537163	10.462837	9.564592	10.435408	10.027430	9.972570	51	24
37	15	9.537249	10.462751	9.564690	10.435310	10.027441	9.972559	45	23
38	30	9.537335	10.462665	9.564788	10.435212	10.027453	9.972547	30	22
39	45	9.537421	10.462579	9.564885	10.435115	10.027465	9.972535	15	21
40	10	9.537507	10.462493	9.564983	10.435017	10.027476	9.972524	50	20
41	15	9.537593	10.462407	9.565081	10.434919	10.027488	9.972512	45	19
42	30	9.537679	10.462321	9.565178	10.434822	10.027499	9.972501	30	18
43	45	9.537765	10.462235	9.565276	10.434724	10.027511	9.972489	15	17
44	11	9.537851	10.462149	9.565373	10.434627	10.027523	9.972477	49	16
45	15	9.537937	10.462063	9.565471	10.434529	10.027534	9.972466	45	15
46	30	9.538023	10.461977	9.565568	10.434432	10.027546	9.972454	30	14
47	45	9.538108	10.461892	9.565666	10.434334	10.027557	9.972443	15	13
48	12	9.538194	10.461806	9.565763	10.434237	10.027569	9.972431	48	12
49	15	9.538280	10.461720	9.565861	10.434139	10.027581	9.972419	45	11
50	30	9.538366	10.461634	9.565958	10.434042	10.027592	9.972408	30	10
51	45	9.538452	10.461548	9.566056	10.433944	10.027604	9.972396	15	9
52	13	9.538537	10.461463	9.566153	10.433847	10.027616	9.972384	47	8
53	15	9.538623	10.461377	9.566250	10.433750	10.027627	9.972373	45	7
54	30	9.538709	10.461291	9.566348	10.433652	10.027639	9.972361	30	6
55	45	9.538795	10.461205	9.566445	10.433555	10.027650	9.972350	15	5
56	14	9.538880	10.461120	9.566542	10.433458	10.027662	9.972338	46	4
57	15	9.538966	10.461034	9.566640	10.433360	10.027674	9.972326	45	3
58	30	9.539052	10.460948	9.566737	10.433263	10.027685	9.972315	30	2
59	45	9.539137	10.460863	9.566834	10.433166	10.027697	9.972303	15	1
60	15	9.539223	10.460777	9.566932	10.433068	10.027709	9.972291	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 39 ^m .		LOG. SINES, &c.						69 deg.	

1 ^h 21 ^m .		LOG. SINES, &c. (t.)						20 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.539223	10.460777	9.566932	10.433068	10.027709	9.972291	45	60
1	15	9.539309	10.460691	9.567029	10.432971	10.027720	9.972280	45	59
2	30	9.539394	10.460606	9.567126	10.432874	10.027732	9.972268	30	58
3	45	9.539480	10.460520	9.567223	10.432777	10.027744	9.972256	15	57
4	16	9.539565	10.460435	9.567320	10.432680	10.027755	9.972245	44	56
5	15	9.539651	10.460349	9.567418	10.432582	10.027767	9.972233	45	55
6	30	9.539736	10.460264	9.567515	10.432485	10.027779	9.972221	30	54
7	45	9.539822	10.460178	9.567612	10.432388	10.027790	9.972210	15	53
8	17	9.539907	10.460093	9.567709	10.432291	10.027802	9.972198	43	52
9	15	9.539993	10.460007	9.567806	10.432194	10.027814	9.972186	45	51
10	30	9.540078	10.459922	9.567903	10.432097	10.027825	9.972175	30	50
11	45	9.540163	10.459837	9.568000	10.432000	10.027837	9.972163	15	49
12	18	9.540249	10.459751	9.568097	10.431903	10.027849	9.972151	42	48
13	15	9.540334	10.459666	9.568195	10.431805	10.027860	9.972140	45	47
14	30	9.540420	10.459580	9.568292	10.431708	10.027872	9.972128	30	46
15	45	9.540505	10.459495	9.568389	10.431611	10.027884	9.972116	15	45
16	19	9.540590	10.459410	9.568486	10.431514	10.027895	9.972105	41	44
17	15	9.540676	10.459324	9.568583	10.431417	10.027907	9.972093	45	43
18	30	9.540761	10.459239	9.568680	10.431320	10.027919	9.972081	30	42
19	45	9.540846	10.459154	9.568777	10.431223	10.027930	9.972070	15	41
20	20	9.540931	10.459069	9.568873	10.431127	10.027942	9.972058	40	40
21	15	9.541017	10.458983	9.568970	10.431030	10.027954	9.972046	45	39
22	30	9.541102	10.458898	9.569067	10.430933	10.027966	9.972034	30	38
23	45	9.541187	10.458813	9.569164	10.430836	10.027977	9.972023	15	37
24	21	9.541272	10.458728	9.569261	10.430739	10.027989	9.972011	39	36
25	15	9.541357	10.458643	9.569358	10.430642	10.028001	9.971999	45	35
26	30	9.541442	10.458558	9.569455	10.430545	10.028012	9.971988	30	34
27	45	9.541527	10.458473	9.569552	10.430448	10.028024	9.971976	15	33
28	22	9.541613	10.458387	9.569648	10.430352	10.028036	9.971964	38	32
29	15	9.541698	10.458302	9.569745	10.430255	10.028048	9.971952	45	31
30	30	9.541783	10.458217	9.569842	10.430158	10.028059	9.971941	30	30
31	45	9.541868	10.458132	9.569939	10.430061	10.028071	9.971929	15	29
32	23	9.541953	10.458047	9.570035	10.429965	10.028083	9.971917	37	28
33	15	9.542038	10.457962	9.570132	10.429868	10.028095	9.971905	45	27
34	30	9.542123	10.457877	9.570229	10.429771	10.028106	9.971894	30	26
35	45	9.542208	10.457792	9.570326	10.429674	10.028118	9.971882	15	25
36	24	9.542293	10.457707	9.570422	10.429578	10.028130	9.971870	36	24
37	15	9.542377	10.457623	9.570519	10.429481	10.028142	9.971858	45	23
38	30	9.542462	10.457538	9.570616	10.429384	10.028153	9.971847	30	22
39	45	9.542547	10.457453	9.570712	10.429288	10.028165	9.971835	15	21
40	25	9.542632	10.457368	9.570809	10.429191	10.028177	9.971823	35	20
41	15	9.542717	10.457283	9.570905	10.429095	10.028189	9.971811	45	19
42	30	9.542802	10.457198	9.571002	10.428998	10.028200	9.971800	30	18
43	45	9.542887	10.457113	9.571099	10.428901	10.028212	9.971788	15	17
44	26	9.542971	10.457029	9.571195	10.428805	10.028224	9.971776	34	16
45	15	9.543056	10.456944	9.571292	10.428708	10.028236	9.971764	45	15
46	30	9.543141	10.456859	9.571388	10.428612	10.028247	9.971753	30	14
47	45	9.543226	10.456774	9.571485	10.428515	10.028259	9.971741	15	13
48	27	9.543310	10.456690	9.571581	10.428419	10.028271	9.971729	33	12
49	15	9.543395	10.456605	9.571678	10.428322	10.028283	9.971717	45	11
50	30	9.543480	10.456520	9.571774	10.428226	10.028294	9.971706	30	10
51	45	9.543564	10.456436	9.571870	10.428130	10.028306	9.971694	15	9
52	28	9.543649	10.456351	9.571967	10.428033	10.028318	9.971682	32	8
53	15	9.543733	10.456267	9.572063	10.427937	10.028330	9.971670	45	7
54	30	9.543818	10.456182	9.572160	10.427840	10.028342	9.971658	30	6
55	45	9.543903	10.456097	9.572256	10.427744	10.028353	9.971647	15	5
56	29	9.543987	10.456013	9.572352	10.427648	10.028365	9.971635	31	4
57	15	9.544072	10.455928	9.572449	10.427551	10.028377	9.971623	45	3
58	30	9.544156	10.455844	9.572545	10.427455	10.028389	9.971611	30	2
59	45	9.544241	10.455759	9.572641	10.427359	10.028401	9.971599	15	1
60	30	9.544325	10.455675	9.572738	10.427262	10.028412	9.971588	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 38 ^m .		LOG. SINES, &c.						69 deg.	

1 ^h 22 ^m .		LOG. SINES, &c. (t.)						20 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.544325	10.455675	9.572738	10.427262	10.028412	9.971588	30	60
1	15	9.544410	10.455590	9.572834	10.427166	10.028424	9.971576	45	59
2	30	9.544494	10.455506	9.572930	10.427070	10.028436	9.971564	30	58
3	45	9.544579	10.455421	9.573026	10.426974	10.028448	9.971552	15	57
4	31	9.544663	10.455337	9.573123	10.426877	10.028460	9.971540	29	56
5	15	9.544747	10.455253	9.573219	10.426781	10.028471	9.971529	45	55
6	30	9.544832	10.455168	9.573315	10.426685	10.028483	9.971517	30	54
7	45	9.544916	10.455084	9.573411	10.426589	10.028495	9.971505	15	53
8	32	9.545000	10.455000	9.573507	10.426493	10.028507	9.971493	28	52
9	15	9.545085	10.454915	9.573603	10.426397	10.028519	9.971481	45	51
10	30	9.545169	10.454831	9.573700	10.426300	10.028531	9.971469	30	50
11	45	9.545253	10.454747	9.573796	10.426204	10.028542	9.971458	15	49
12	33	9.545338	10.454662	9.573892	10.426108	10.028554	9.971446	27	48
13	15	9.545422	10.454578	9.573988	10.426012	10.028566	9.971434	45	47
14	30	9.545506	10.454494	9.574084	10.425916	10.028578	9.971422	30	46
15	45	9.545590	10.454410	9.574180	10.425820	10.028590	9.971410	15	45
16	34	9.545674	10.454326	9.574276	10.425724	10.028602	9.971398	26	44
17	15	9.545759	10.454241	9.574372	10.425628	10.028614	9.971386	45	43
18	30	9.545843	10.454157	9.574468	10.425532	10.028625	9.971375	30	42
19	45	9.545927	10.454073	9.574564	10.425436	10.028637	9.971363	15	41
20	35	9.546011	10.453989	9.574660	10.425340	10.028649	9.971351	25	40
21	15	9.546095	10.453905	9.574756	10.425244	10.028661	9.971339	45	39
22	30	9.546179	10.453821	9.574852	10.425148	10.028673	9.971327	30	38
23	45	9.546263	10.453737	9.574948	10.425052	10.028685	9.971315	15	37
24	36	9.546347	10.453653	9.575044	10.424956	10.028697	9.971303	24	36
25	15	9.546431	10.453569	9.575140	10.424860	10.028708	9.971292	45	35
26	30	9.546515	10.453485	9.575235	10.424765	10.028720	9.971280	30	34
27	45	9.546599	10.453401	9.575331	10.424669	10.028732	9.971268	15	33
28	37	9.546683	10.453317	9.575427	10.424573	10.028744	9.971256	23	32
29	15	9.546767	10.453233	9.575523	10.424477	10.028756	9.971244	45	31
30	30	9.546851	10.453149	9.575619	10.424381	10.028768	9.971232	30	30
31	45	9.546935	10.453065	9.575715	10.424285	10.028780	9.971220	15	29
32	38	9.547019	10.452981	9.575810	10.424190	10.028792	9.971208	22	28
33	15	9.547103	10.452897	9.575906	10.424094	10.028804	9.971196	45	27
34	30	9.547187	10.452813	9.576002	10.423998	10.028815	9.971185	30	26
35	45	9.547270	10.452730	9.576098	10.423902	10.028827	9.971173	15	25
36	39	9.547354	10.452646	9.576193	10.423807	10.028839	9.971161	21	24
37	15	9.547438	10.452562	9.576289	10.423711	10.028851	9.971149	45	23
38	30	9.547522	10.452478	9.576385	10.423615	10.028863	9.971137	30	22
39	45	9.547605	10.452395	9.576480	10.423520	10.028875	9.971125	15	21
40	40	9.547689	10.452311	9.576576	10.423424	10.028887	9.971113	20	20
41	15	9.547773	10.452227	9.576672	10.423328	10.028899	9.971101	45	19
42	30	9.547857	10.452143	9.576767	10.423233	10.028911	9.971089	30	18
43	45	9.547940	10.452060	9.576863	10.423137	10.028923	9.971077	15	17
44	41	9.548024	10.451976	9.576958	10.423042	10.028935	9.971065	19	16
45	15	9.548108	10.451892	9.577054	10.422946	10.028946	9.971054	45	15
46	30	9.548191	10.451809	9.577150	10.422850	10.028958	9.971042	30	14
47	45	9.548275	10.451725	9.577245	10.422755	10.028970	9.971030	15	13
48	42	9.548358	10.451642	9.577341	10.422659	10.028982	9.971018	18	12
49	15	9.548442	10.451558	9.577436	10.422564	10.028994	9.971006	45	11
50	30	9.548526	10.451474	9.577532	10.422468	10.029006	9.970994	30	10
51	45	9.548609	10.451391	9.577627	10.422373	10.029018	9.970982	15	9
52	43	9.548693	10.451307	9.577723	10.422277	10.029030	9.970970	17	8
53	15	9.548776	10.451224	9.577818	10.422182	10.029042	9.970958	45	7
54	30	9.548860	10.451140	9.577913	10.422087	10.029054	9.970946	30	6
55	45	9.548943	10.451057	9.578009	10.421991	10.029066	9.970934	15	5
56	44	9.549027	10.450973	9.578104	10.421896	10.029078	9.970922	16	4
57	15	9.549110	10.450890	9.578200	10.421800	10.029090	9.970910	45	3
58	30	9.549193	10.450807	9.578295	10.421705	10.029102	9.970898	30	2
59	45	9.549277	10.450723	9.578390	10.421610	10.029114	9.970886	15	1
60	45	9.549360	10.450640	9.578486	10.421514	10.029126	9.970874	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 37 ^m .		LOG. SINES, &c.						69 deg.	

1 ^h 23 ^m .		LOG. SINES, &c. (t.)						20 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	45	9.549360	10.450640	9.578486	10.421514	10.029126	9.970874	15		60
1	15	9.549443	10.450557	9.578581	10.421419	10.029138	9.970862	45		59
2	30	9.549527	10.450473	9.578676	10.421324	10.029150	9.970850	30		58
3	45	9.549610	10.450390	9.578772	10.421228	10.029162	9.970838	15		57
4	46	9.549693	10.450307	9.578867	10.421133	10.029174	9.970826	14		56
5	15	9.549777	10.450223	9.578962	10.421038	10.029186	9.970814	45		55
6	30	9.549860	10.450140	9.579057	10.420943	10.029197	9.970803	30		54
7	45	9.549943	10.450057	9.579153	10.420847	10.029209	9.970791	15		53
8	47	9.550026	10.449974	9.579248	10.420752	10.029221	9.970779	13		52
9	15	9.550110	10.449890	9.579343	10.420657	10.029233	9.970767	45		51
10	30	9.550193	10.449807	9.579438	10.420562	10.029245	9.970755	30		50
11	45	9.550276	10.449724	9.579533	10.420467	10.029257	9.970743	15		49
12	48	9.550359	10.449641	9.579629	10.420371	10.029269	9.970731	12		48
13	15	9.550442	10.449558	9.579724	10.420276	10.029281	9.970719	45		47
14	30	9.550525	10.449475	9.579819	10.420181	10.029293	9.970707	30		46
15	45	9.550608	10.449392	9.579914	10.420086	10.029305	9.970695	15		45
16	49	9.550692	10.449308	9.580009	10.419991	10.029317	9.970683	11		44
17	15	9.550775	10.449225	9.580104	10.419896	10.029329	9.970671	45		43
18	30	9.550858	10.449142	9.580199	10.419801	10.029341	9.970659	30		42
19	45	9.550941	10.449059	9.580294	10.419706	10.029353	9.970647	15		41
20	50	9.551024	10.448976	9.580389	10.419611	10.029365	9.970635	10		40
21	15	9.551107	10.448893	9.580484	10.419516	10.029377	9.970623	45		39
22	30	9.551190	10.448810	9.580579	10.419421	10.029390	9.970610	30		38
23	45	9.551273	10.448727	9.580674	10.419326	10.029402	9.970598	15		37
24	51	9.551356	10.448644	9.580769	10.419231	10.029414	9.970586	9		36
25	15	9.551438	10.448562	9.580864	10.419136	10.029426	9.970574	45		35
26	30	9.551521	10.448479	9.580959	10.419041	10.029438	9.970562	30		34
27	45	9.551604	10.448396	9.581054	10.418946	10.029450	9.970550	15		33
28	52	9.551687	10.448313	9.581149	10.418851	10.029462	9.970538	8		32
29	15	9.551770	10.448230	9.581244	10.418756	10.029474	9.970526	45		31
30	30	9.551853	10.448147	9.581338	10.418662	10.029486	9.970514	30		30
31	45	9.551936	10.448064	9.581433	10.418567	10.029498	9.970502	15		29
32	53	9.552018	10.447982	9.581528	10.418472	10.029510	9.970490	7		28
33	15	9.552101	10.447899	9.581623	10.418377	10.029522	9.970478	45		27
34	30	9.552184	10.447816	9.581718	10.418282	10.029534	9.970466	30		26
35	45	9.552267	10.447733	9.581813	10.418187	10.029546	9.970454	15		25
36	54	9.552349	10.447651	9.581907	10.418093	10.029558	9.970442	6		24
37	15	9.552432	10.447568	9.582002	10.417998	10.029570	9.970430	45		23
38	30	9.552515	10.447485	9.582097	10.417903	10.029582	9.970418	30		22
39	45	9.552597	10.447403	9.582192	10.417808	10.029594	9.970406	15		21
40	55	9.552680	10.447320	9.582286	10.417714	10.029606	9.970394	5		20
41	15	9.552763	10.447237	9.582381	10.417619	10.029618	9.970382	45		19
42	30	9.552845	10.447155	9.582476	10.417524	10.029631	9.970370	30		18
43	45	9.552928	10.447072	9.582570	10.417430	10.029643	9.970357	15		17
44	56	9.553010	10.446990	9.582665	10.417335	10.029655	9.970345	4		16
45	15	9.553093	10.446907	9.582760	10.417240	10.029667	9.970333	45		15
46	30	9.553175	10.446825	9.582854	10.417146	10.029679	9.970321	30		14
47	45	9.553258	10.446742	9.582949	10.417051	10.029691	9.970309	15		13
48	57	9.553341	10.446659	9.583043	10.416957	10.029703	9.970297	3		12
49	15	9.553423	10.446577	9.583138	10.416862	10.029715	9.970285	45		11
50	30	9.553505	10.446495	9.583233	10.416767	10.029727	9.970273	30		10
51	45	9.553588	10.446412	9.583327	10.416673	10.029739	9.970261	15		9
52	58	9.553670	10.446330	9.583422	10.416578	10.029751	9.970249	2		8
53	15	9.553753	10.446247	9.583516	10.416484	10.029764	9.970236	45		7
54	30	9.553835	10.446165	9.583611	10.416389	10.029776	9.970224	30		6
55	45	9.553918	10.446082	9.583705	10.416295	10.029788	9.970212	15		5
56	59	9.554000	10.446000	9.583800	10.416200	10.029800	9.970200	1		4
57	15	9.554082	10.445918	9.583894	10.416106	10.029812	9.970188	45		3
58	30	9.554165	10.445835	9.583989	10.416011	10.029824	9.970176	30		2
59	45	9.554247	10.445753	9.584083	10.415917	10.029836	9.970164	15		1
60	60	9.554329	10.445671	9.584177	10.415823	10.029848	9.970152	0		0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	"	sec.
4 ^h 36 ^m .		LOG. SINES, &c.						69 deg.		

1 ^h 24 ^m .		LOG. SINES, &c. (t.)						21 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	sec.	"
0	0	9.554329	10.445671	9.584177	10.415823	10.029848	9.970152	60	60
1	15	9.554411	10.445589	9.584272	10.415728	10.029860	9.970140	45	59
2	30	9.554494	10.445506	9.584366	10.415634	10.029873	9.970127	30	58
3	45	9.554576	10.445424	9.584461	10.415539	10.029885	9.970115	15	57
4	1	9.554658	10.445342	9.584555	10.415445	10.029897	9.970103	59	56
5	15	9.554740	10.445260	9.584649	10.415351	10.029909	9.970091	45	55
6	30	9.554822	10.445178	9.584743	10.415257	10.029921	9.970079	30	54
7	45	9.554905	10.445095	9.584838	10.415162	10.029933	9.970067	15	53
8	2	9.554987	10.445013	9.584932	10.415068	10.029945	9.970055	58	52
9	15	9.555069	10.444931	9.585026	10.414974	10.029958	9.970042	45	51
10	30	9.555151	10.444849	9.585121	10.414879	10.029970	9.970030	30	50
11	45	9.555233	10.444767	9.585215	10.414785	10.029982	9.970018	15	49
12	3	9.555315	10.444685	9.585309	10.414691	10.029994	9.970006	57	48
13	15	9.555397	10.444603	9.585403	10.414597	10.030006	9.969994	45	47
14	30	9.555479	10.444521	9.585497	10.414503	10.030018	9.969982	30	46
15	45	9.555561	10.444439	9.585592	10.414408	10.030030	9.969970	15	45
16	4	9.555643	10.444357	9.585686	10.414314	10.030043	9.969957	56	44
17	15	9.555725	10.444275	9.585780	10.414220	10.030055	9.969945	45	43
18	30	9.555807	10.444193	9.585874	10.414126	10.030067	9.969933	30	42
19	45	9.555889	10.444111	9.585968	10.414032	10.030079	9.969921	15	41
20	5	9.555971	10.444029	9.586062	10.413938	10.030091	9.969909	55	40
21	15	9.556053	10.443947	9.586156	10.413844	10.030103	9.969897	45	39
22	30	9.556135	10.443865	9.586250	10.413750	10.030116	9.969884	30	38
23	45	9.556217	10.443783	9.586345	10.413655	10.030128	9.969872	15	37
24	6	9.556299	10.443701	9.586439	10.413561	10.030140	9.969860	54	36
25	15	9.556380	10.443620	9.586533	10.413467	10.030152	9.969848	45	35
26	30	9.556462	10.443538	9.586627	10.413373	10.030164	9.969836	30	34
27	45	9.556544	10.443456	9.586721	10.413279	10.030177	9.969823	15	33
28	7	9.556626	10.443374	9.586815	10.413185	10.030189	9.969811	53	32
29	15	9.556708	10.443292	9.586909	10.413091	10.030201	9.969799	45	31
30	30	9.556789	10.443211	9.587003	10.412997	10.030213	9.969787	30	30
31	45	9.556871	10.443129	9.587096	10.412904	10.030225	9.969775	15	29
32	8	9.556953	10.443047	9.587190	10.412810	10.030238	9.969762	52	28
33	15	9.557035	10.442965	9.587284	10.412716	10.030250	9.969750	45	27
34	30	9.557116	10.442884	9.587378	10.412622	10.030262	9.969738	30	26
35	45	9.557198	10.442802	9.587472	10.412528	10.030274	9.969726	15	25
36	9	9.557280	10.442720	9.587566	10.412434	10.030286	9.969714	51	24
37	15	9.557361	10.442639	9.587660	10.412340	10.030299	9.969701	45	23
38	30	9.557443	10.442557	9.587754	10.412246	10.030311	9.969689	30	22
39	45	9.557524	10.442476	9.587847	10.412153	10.030323	9.969677	15	21
40	10	9.557606	10.442394	9.587941	10.412059	10.030335	9.969665	50	20
41	15	9.557687	10.442313	9.588035	10.411965	10.030348	9.969652	45	19
42	30	9.557769	10.442231	9.588129	10.411871	10.030360	9.969640	30	18
43	45	9.557851	10.442149	9.588223	10.411777	10.030372	9.969628	15	17
44	11	9.557932	10.442068	9.588316	10.411684	10.030384	9.969616	49	16
45	15	9.558014	10.441986	9.588410	10.411590	10.030397	9.969603	45	15
46	30	9.558095	10.441905	9.588504	10.411496	10.030409	9.969591	30	14
47	45	9.558176	10.441824	9.588597	10.411403	10.030421	9.969579	15	13
48	12	9.558258	10.441742	9.588691	10.411309	10.030433	9.969567	48	12
49	15	9.558339	10.441661	9.588785	10.411215	10.030446	9.969554	45	11
50	30	9.558421	10.441579	9.588878	10.411122	10.030458	9.969542	30	10
51	45	9.558502	10.441498	9.588972	10.411028	10.030470	9.969530	15	9
52	13	9.558583	10.441417	9.589066	10.410934	10.030482	9.969518	47	8
53	15	9.558665	10.441335	9.589159	10.410841	10.030495	9.969505	45	7
54	30	9.558746	10.441254	9.589253	10.410747	10.030507	9.969493	30	6
55	45	9.558827	10.441173	9.589346	10.410654	10.030519	9.969481	15	5
56	14	9.558909	10.441091	9.589440	10.410560	10.030531	9.969469	46	4
57	15	9.558990	10.441010	9.589534	10.410466	10.030544	9.969456	45	3
58	30	9.559071	10.440929	9.589627	10.410373	10.030556	9.969444	30	2
59	45	9.559152	10.440848	9.589721	10.410279	10.030568	9.969432	15	1
60	15	9.559234	10.440766	9.589814	10.410186	10.030580	9.969420	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
4 ^h 35 ^m .		LOG. SINES, &c.						68 deg.	

1 ^h 25 ^m .		LOG. SINES, &c. (t.)						21 deg.	
sec.	"	sine.	cosecant.	tang ^{nt} .	cotangent.	secant.	cosine.	"	sec.
0	15	9.559234	10.440766	9.589814	10.410186	10.030580	9.969420	45	60
1	15	9.559315	10.440685	9.589908	10.410092	10.030593	9.969407	45	59
2	30	9.559396	10.440604	9.590001	10.409999	10.030605	9.969395	30	58
3	45	9.559477	10.440523	9.590095	10.409905	10.030617	9.969383	15	57
4	16	9.559558	10.440442	9.590188	10.409812	10.030630	9.969370	44	56
5	15	9.559640	10.440360	9.590281	10.409719	10.030642	9.969358	45	55
6	30	9.559721	10.440279	9.590375	10.409625	10.030654	9.969346	30	54
7	45	9.559802	10.440198	9.590468	10.409532	10.030667	9.969333	15	53
8	17	9.559883	10.440117	9.590562	10.409438	10.030679	9.969321	43	52
9	15	9.559964	10.440036	9.590655	10.409345	10.030691	9.969309	45	51
10	30	9.560045	10.439955	9.590748	10.409252	10.030703	9.969297	30	50
11	45	9.560126	10.439874	9.590842	10.409158	10.030716	9.969284	15	49
12	18	9.560207	10.439793	9.590935	10.409065	10.030728	9.969272	42	48
13	15	9.560288	10.439712	9.591028	10.408972	10.030740	9.969260	45	47
14	30	9.560369	10.439631	9.591122	10.408878	10.030753	9.969247	30	46
15	45	9.560450	10.439550	9.591215	10.408785	10.030765	9.969235	15	45
16	19	9.560531	10.439469	9.591308	10.408692	10.030777	9.969223	41	44
17	15	9.560612	10.439388	9.591401	10.408599	10.030790	9.969210	45	43
18	30	9.560693	10.439307	9.591495	10.408505	10.030802	9.969198	30	42
19	45	9.560774	10.439226	9.591588	10.408412	10.030814	9.969186	15	41
20	20	9.560855	10.439145	9.591681	10.408319	10.030827	9.969173	40	40
21	15	9.560935	10.439065	9.591774	10.408226	10.030839	9.969161	45	39
22	30	9.561016	10.438984	9.591867	10.408133	10.030851	9.969149	30	38
23	45	9.561097	10.438903	9.591961	10.408039	10.030864	9.969136	15	37
24	21	9.561178	10.438822	9.592054	10.407946	10.030876	9.969124	39	36
25	15	9.561259	10.438741	9.592147	10.407853	10.030888	9.969112	45	35
26	30	9.561339	10.438661	9.592240	10.407760	10.030901	9.969099	30	34
27	45	9.561420	10.438580	9.592333	10.407667	10.030913	9.969087	15	33
28	22	9.561501	10.438499	9.592426	10.407574	10.030925	9.969075	38	32
29	15	9.561582	10.438418	9.592519	10.407481	10.030938	9.969062	45	31
30	30	9.561662	10.438338	9.592612	10.407388	10.030950	9.969050	30	30
31	45	9.561743	10.438257	9.592705	10.407295	10.030962	9.969038	15	29
32	23	9.561824	10.438176	9.592798	10.407202	10.030975	9.969025	37	28
33	15	9.561904	10.438096	9.592891	10.407109	10.030987	9.969013	45	27
34	30	9.561985	10.438015	9.592985	10.407015	10.031000	9.969000	30	26
35	45	9.562066	10.437934	9.593077	10.406923	10.031012	9.968988	15	25
36	24	9.562146	10.437854	9.593170	10.406830	10.031024	9.968976	36	24
37	15	9.562227	10.437773	9.593263	10.406737	10.031037	9.968963	45	23
38	30	9.562307	10.437693	9.593356	10.406644	10.031049	9.968951	30	22
39	45	9.562388	10.437612	9.593449	10.406551	10.031061	9.968939	15	21
40	25	9.562468	10.437532	9.593542	10.406458	10.031074	9.968926	35	20
41	15	9.562549	10.437451	9.593635	10.406365	10.031086	9.968914	45	19
42	30	9.562629	10.437371	9.593728	10.406272	10.031099	9.968901	30	18
43	45	9.562710	10.437290	9.593821	10.406179	10.031111	9.968889	15	17
44	26	9.562790	10.437210	9.593914	10.406086	10.031123	9.968877	34	16
45	15	9.562871	10.437129	9.594007	10.405993	10.031136	9.968864	45	15
46	30	9.562951	10.437049	9.594099	10.405901	10.031148	9.968852	30	14
47	45	9.563032	10.436968	9.594192	10.405808	10.031161	9.968839	15	13
48	27	9.563112	10.436888	9.594285	10.405715	10.031173	9.968827	33	12
49	15	9.563192	10.436808	9.594378	10.405622	10.031185	9.968815	45	11
50	30	9.563273	10.436727	9.594471	10.405529	10.031198	9.968803	30	10
51	45	9.563353	10.436647	9.594563	10.405437	10.031210	9.968790	15	9
52	28	9.563433	10.436567	9.594656	10.405344	10.031223	9.968777	32	8
53	15	9.563514	10.436486	9.594749	10.405251	10.031235	9.968765	45	7
54	30	9.563594	10.436406	9.594842	10.405158	10.031248	9.968752	30	6
55	45	9.563674	10.436326	9.594934	10.405066	10.031260	9.968740	15	5
56	29	9.563755	10.436245	9.595027	10.404973	10.031272	9.968728	31	4
57	15	9.563835	10.436165	9.595120	10.404880	10.031285	9.968715	45	3
58	30	9.563915	10.436085	9.595212	10.404788	10.031297	9.968703	30	2
59	45	9.563995	10.436005	9.595305	10.404695	10.031310	9.968690	15	1
60	30	9.564075	10.435925	9.595397	10.404603	10.031322	9.968678	30	0
sec.	"	co-sine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 34 ^m .		LOG. SINES, &c.						68 deg.	

1 ^h 26 ^m .		LOG. SINES, &c. (t.)						21 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.564075	10.435925	9.595397	10.404603	10.031322	9.968678	30	60
1	15	9.564156	10.435844	9.595490	10.404510	10.031335	9.968665	45	59
2	30	9.564236	10.435764	9.595583	10.404417	10.031347	9.968653	30	58
3	45	9.564316	10.435684	9.595675	10.404325	10.031359	9.968641	15	57
4	31	9.564396	10.435604	9.595768	10.404232	10.031372	9.968628	29	56
5	15	9.564476	10.435524	9.595860	10.404140	10.031384	9.968616	45	55
6	30	9.564556	10.435444	9.595953	10.404047	10.031397	9.968603	30	54
7	45	9.564636	10.435364	9.596045	10.403955	10.031409	9.968591	15	53
8	32	9.564716	10.435284	9.596138	10.403862	10.031422	9.968578	28	52
9	15	9.564796	10.435204	9.596230	10.403770	10.031434	9.968566	45	51
10	30	9.564876	10.435124	9.596323	10.403677	10.031447	9.968553	30	50
11	45	9.564956	10.435044	9.596415	10.403585	10.031459	9.968541	15	49
12	33	9.565036	10.434964	9.596508	10.403492	10.031472	9.968528	27	48
13	15	9.565116	10.434884	9.596600	10.403400	10.031484	9.968516	45	47
14	30	9.565196	10.434804	9.596693	10.403307	10.031497	9.968503	30	46
15	45	9.565276	10.434724	9.596785	10.403215	10.031509	9.968491	15	45
16	34	9.565356	10.434644	9.596878	10.403122	10.031522	9.968478	26	44
17	15	9.565436	10.434564	9.596970	10.403030	10.031534	9.968466	45	43
18	30	9.565516	10.434484	9.597062	10.402938	10.031547	9.968453	30	42
19	45	9.565596	10.434404	9.597155	10.402845	10.031559	9.968441	15	41
20	35	9.565676	10.434324	9.597247	10.402753	10.031571	9.968429	25	40
21	15	9.565755	10.434245	9.597339	10.402661	10.031584	9.968416	45	39
22	30	9.565835	10.434165	9.597432	10.402568	10.031596	9.968404	30	38
23	45	9.565915	10.434085	9.597524	10.402476	10.031609	9.968391	15	37
24	36	9.565995	10.434005	9.597616	10.402384	10.031621	9.968379	24	36
25	15	9.566074	10.433926	9.597708	10.402292	10.031634	9.968366	45	35
26	30	9.566154	10.433846	9.597801	10.402199	10.031647	9.968353	30	34
27	45	9.566234	10.433766	9.597893	10.402107	10.031659	9.968341	15	33
28	37	9.566314	10.433686	9.597985	10.402015	10.031672	9.968328	23	32
29	15	9.566393	10.433607	9.598077	10.401923	10.031684	9.968316	45	31
30	30	9.566473	10.433527	9.598170	10.401830	10.031697	9.968303	30	30
31	45	9.566553	10.433447	9.598262	10.401738	10.031709	9.968291	15	29
32	38	9.566632	10.433368	9.598354	10.401646	10.031722	9.968278	22	28
33	15	9.566712	10.433288	9.598446	10.401554	10.031734	9.968266	45	27
34	30	9.566792	10.433208	9.598538	10.401462	10.031747	9.968253	30	26
35	45	9.566871	10.433129	9.598630	10.401370	10.031759	9.968241	15	25
36	39	9.566951	10.433049	9.598722	10.401278	10.031772	9.968228	21	24
37	15	9.567030	10.432970	9.598815	10.401185	10.031784	9.968216	45	23
38	30	9.567110	10.432890	9.598907	10.401093	10.031797	9.968203	30	22
39	45	9.567189	10.432811	9.598999	10.401001	10.031809	9.968191	15	21
40	40	9.567269	10.432731	9.599091	10.400909	10.031822	9.968178	20	20
41	15	9.567348	10.432652	9.599183	10.400817	10.031834	9.968166	45	19
42	30	9.567428	10.432572	9.599275	10.400725	10.031847	9.968153	30	18
43	45	9.567507	10.432493	9.599367	10.400633	10.031860	9.968140	15	17
44	41	9.567587	10.432413	9.599459	10.400541	10.031872	9.968128	19	16
45	15	9.567666	10.432334	9.599551	10.400449	10.031885	9.968115	45	15
46	30	9.567746	10.432254	9.599643	10.400357	10.031897	9.968103	30	14
47	46	9.567825	10.432175	9.599735	10.400265	10.031910	9.968090	15	13
48	42	9.567904	10.432096	9.599827	10.400173	10.031922	9.968078	18	12
49	15	9.567984	10.432016	9.599919	10.400081	10.031935	9.968065	45	11
50	30	9.568063	10.431937	9.600010	10.399990	10.031948	9.968052	30	10
51	45	9.568142	10.431858	9.600102	10.399898	10.031960	9.968040	15	9
52	43	9.568222	10.431778	9.600194	10.399806	10.031973	9.968027	17	8
53	15	9.568301	10.431699	9.600286	10.399714	10.031985	9.968015	45	7
54	30	9.568380	10.431620	9.600378	10.399622	10.031998	9.968002	30	6
55	45	9.568459	10.431541	9.600470	10.399530	10.032010	9.967990	15	5
56	44	9.568539	10.431461	9.600562	10.399438	10.032023	9.967977	16	4
57	15	9.568618	10.431382	9.600653	10.399347	10.032036	9.967964	45	3
58	30	9.568697	10.431303	9.600745	10.399255	10.032048	9.967952	30	2
59	45	9.568776	10.431224	9.600837	10.399163	10.032061	9.967939	15	1
60	45	9.568855	10.431145	9.600929	10.399071	10.032073	9.967927	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 33 ^m .		LOG. SINES, &c.						68 deg.	

1 ⁿ 27 ^m .		LOG. SINES, &c. (t.)						21 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine	"	sec.
0	45	9.568355	10.431145	9.600929	10.399071	10.032073	9.967927	15	60
1	15	9.568935	10.431065	9.601021	10.398979	10.032086	9.967914	45	59
2	30	9.569014	10.430986	9.601112	10.398888	10.032099	9.967901	30	58
3	45	9.569093	10.430907	9.601204	10.398796	10.032111	9.967889	15	57
4	46	9.569172	10.430828	9.601296	10.398704	10.032124	9.967876	14	56
5	15	9.569251	10.430749	9.601387	10.398613	10.032136	9.967864	45	55
6	30	9.569330	10.430670	9.601479	10.398521	10.032149	9.967851	30	54
7	45	9.569409	10.430591	9.601571	10.398429	10.032162	9.967838	15	53
8	47	9.569488	10.430512	9.601662	10.398338	10.032174	9.967826	13	52
9	15	9.569567	10.430433	9.601754	10.398246	10.032187	9.967813	45	51
10	30	9.569646	10.430354	9.601846	10.398154	10.032200	9.967800	30	50
11	45	9.569725	10.430275	9.601937	10.398063	10.032212	9.967788	15	49
12	48	9.569804	10.430196	9.602029	10.397971	10.032225	9.967775	12	48
13	15	9.569883	10.430117	9.602121	10.397879	10.032237	9.967763	45	47
14	30	9.569962	10.430038	9.602212	10.397788	10.032250	9.967750	30	46
15	45	9.570041	10.429959	9.602304	10.397696	10.032263	9.967737	15	45
16	49	9.570120	10.429880	9.602395	10.397605	10.032275	9.967725	11	44
17	15	9.570199	10.429801	9.602487	10.397513	10.032288	9.967712	45	43
18	30	9.570278	10.429722	9.602578	10.397422	10.032301	9.967699	30	42
19	45	9.570357	10.429643	9.602670	10.397330	10.032313	9.967687	15	41
20	50	9.570435	10.429565	9.602761	10.397239	10.032326	9.967674	10	40
21	15	9.570514	10.429486	9.602853	10.397147	10.032339	9.967661	45	39
22	30	9.570593	10.429407	9.602944	10.397056	10.032351	9.967649	30	38
23	45	9.570672	10.429328	9.603036	10.396964	10.032364	9.967636	15	37
24	51	9.570751	10.429249	9.603127	10.396873	10.032377	9.967623	9	36
25	15	9.570829	10.429171	9.603219	10.396781	10.032389	9.967611	45	35
26	30	9.570908	10.429092	9.603310	10.396690	10.032402	9.967598	30	34
27	45	9.570987	10.429013	9.603401	10.396600	10.032415	9.967585	15	33
28	52	9.571066	10.428934	9.603493	10.396509	10.032427	9.967573	8	32
29	15	9.571144	10.428856	9.603584	10.396416	10.032440	9.967560	45	31
30	30	9.571223	10.428777	9.603675	10.396325	10.032453	9.967547	30	30
31	45	9.571302	10.428698	9.603767	10.396233	10.032465	9.967535	15	29
32	53	9.571380	10.428620	9.603858	10.396142	10.032478	9.967522	7	28
33	15	9.571459	10.428541	9.603949	10.396051	10.032491	9.967509	45	27
34	30	9.571537	10.428463	9.604041	10.395959	10.032503	9.967497	30	26
35	45	9.571616	10.428384	9.604132	10.395868	10.032516	9.967484	15	25
36	54	9.571695	10.428305	9.604223	10.395777	10.032529	9.967471	6	24
37	15	9.571773	10.428227	9.604314	10.395686	10.032541	9.967459	45	23
38	30	9.571852	10.428148	9.604406	10.395594	10.032554	9.967446	30	22
39	45	9.571930	10.428070	9.604497	10.395503	10.032567	9.967433	15	21
40	55	9.572009	10.427991	9.604588	10.395412	10.032580	9.967420	5	20
41	15	9.572087	10.427913	9.604679	10.395321	10.032592	9.967408	45	19
42	30	9.572166	10.427834	9.604771	10.395229	10.032605	9.967395	30	18
43	45	9.572244	10.427756	9.604862	10.395138	10.032618	9.967382	15	17
44	56	9.572323	10.427677	9.604953	10.395047	10.032630	9.967370	4	16
45	15	9.572401	10.427599	9.605044	10.394956	10.032643	9.967357	45	15
46	30	9.572479	10.427521	9.605135	10.394865	10.032656	9.967344	30	14
47	45	9.572558	10.427442	9.605226	10.394774	10.032669	9.967331	15	13
48	57	9.572636	10.427364	9.605317	10.394683	10.032681	9.967319	3	12
49	15	9.572715	10.427285	9.605408	10.394592	10.032694	9.967306	45	11
50	30	9.572793	10.427207	9.605500	10.394500	10.032707	9.967293	30	10
51	45	9.572871	10.427129	9.605591	10.394409	10.032719	9.967281	15	9
52	58	9.572949	10.427051	9.605682	10.394318	10.032732	9.967268	2	8
53	15	9.573028	10.426972	9.605773	10.394227	10.032745	9.967255	45	7
54	30	9.573106	10.426894	9.605864	10.394136	10.032758	9.967242	30	6
55	45	9.573184	10.426816	9.605955	10.394045	10.032770	9.967230	15	5
56	59	9.573263	10.426737	9.606046	10.393954	10.032783	9.967217	1	4
57	15	9.573341	10.426659	9.606137	10.393863	10.032796	9.967204	45	3
58	30	9.573419	10.426581	9.606228	10.393772	10.032809	9.967191	30	2
59	45	9.573497	10.426503	9.606319	10.393681	10.032821	9.967179	15	1
60	60	9.573575	10.426425	9.606410	10.393590	10.032834	9.967166	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

4^h 32^m.

LOG. SINES, &c.

68 deg.

1° 28'		LOG. SINES, &c. (t.)						22 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.573575	10.426425	9.606410	10.393590	10.032034	9.967166	60	60
1	15	9.573654	10.426346	9.606500	10.393500	10.032847	9.967153	45	59
2	30	9.573732	10.426268	9.606591	10.393409	10.032860	9.967140	30	58
3	45	9.573810	10.426190	9.606682	10.393318	10.032872	9.967128	15	57
4	1	9.573888	10.426112	9.606773	10.393227	10.032885	9.967115	59	56
5	15	9.573966	10.426034	9.606864	10.393136	10.032898	9.967102	45	55
6	30	9.574044	10.425956	9.606955	10.393045	10.032911	9.967089	30	54
7	45	9.574122	10.425878	9.607046	10.392954	10.032924	9.967076	15	53
8	2	9.574200	10.425800	9.607137	10.392863	10.032936	9.967064	58	52
9	15	9.574278	10.425722	9.607227	10.392773	10.032949	9.967051	45	51
10	30	9.574356	10.425644	9.607318	10.392682	10.032962	9.967038	30	50
11	45	9.574434	10.425566	9.607409	10.392591	10.032975	9.967025	15	49
12	3	9.574512	10.425488	9.607500	10.392500	10.032988	9.967012	57	48
13	15	9.574590	10.425410	9.607590	10.392410	10.033000	9.967000	45	47
14	30	9.574668	10.425332	9.607681	10.392319	10.033013	9.966987	30	46
15	45	9.574746	10.425254	9.607772	10.392228	10.033026	9.966974	15	45
16	4	9.574824	10.425176	9.607863	10.392137	10.033039	9.966961	56	44
17	15	9.574902	10.425098	9.607953	10.392047	10.033052	9.966948	45	43
18	30	9.574980	10.425020	9.608044	10.391956	10.033064	9.966936	30	42
19	45	9.575058	10.424942	9.608135	10.391865	10.033077	9.966923	15	41
20	5	9.575136	10.424864	9.608225	10.391775	10.033090	9.966910	55	40
21	15	9.575213	10.424787	9.608316	10.391684	10.033103	9.966897	45	39
22	30	9.575291	10.424709	9.608407	10.391593	10.033116	9.966884	30	38
23	45	9.575369	10.424631	9.608497	10.391503	10.033128	9.966872	15	37
24	6	9.575447	10.424553	9.608588	10.391412	10.033141	9.966859	54	36
25	15	9.575525	10.424475	9.608679	10.391321	10.033154	9.966846	45	35
26	30	9.575602	10.424398	9.608769	10.391231	10.033167	9.966833	30	34
27	45	9.575680	10.424320	9.608860	10.391140	10.033180	9.966820	15	33
28	7	9.575758	10.424242	9.608950	10.391050	10.033193	9.966807	53	32
29	15	9.575835	10.424165	9.609041	10.390959	10.033205	9.966795	45	31
30	30	9.575913	10.424087	9.609131	10.390869	10.033218	9.966782	30	30
31	45	9.575991	10.424009	9.609222	10.390778	10.033231	9.966769	15	29
32	8	9.576068	10.423932	9.609312	10.390688	10.033244	9.966756	52	28
33	15	9.576146	10.423854	9.609403	10.390597	10.033257	9.966743	45	27
34	30	9.576224	10.423776	9.609493	10.390507	10.033270	9.966730	30	26
35	45	9.576301	10.423699	9.609584	10.390416	10.033282	9.966718	15	25
36	9	9.576379	10.423621	9.609674	10.390326	10.033295	9.966705	51	24
37	15	9.576457	10.423543	9.609765	10.390235	10.033308	9.966692	45	23
38	30	9.576534	10.423466	9.609855	10.390145	10.033321	9.966679	30	22
39	45	9.576612	10.423388	9.609945	10.390055	10.033334	9.966666	15	21
40	10	9.576689	10.423311	9.610036	10.389964	10.033347	9.966653	50	20
41	15	9.576767	10.423233	9.610126	10.389874	10.033360	9.966640	45	19
42	30	9.576844	10.423156	9.610217	10.389783	10.033372	9.966628	30	18
43	45	9.576922	10.423078	9.610307	10.389693	10.033385	9.966615	15	17
44	11	9.576999	10.423001	9.610397	10.389603	10.033398	9.966602	49	16
45	15	9.577077	10.422923	9.610488	10.389512	10.033411	9.966589	45	15
46	30	9.577154	10.422846	9.610578	10.389422	10.033424	9.966576	30	14
47	45	9.577231	10.422769	9.610668	10.389332	10.033437	9.966563	15	13
48	12	9.577309	10.422691	9.610759	10.389241	10.033450	9.966550	48	12
49	15	9.577386	10.422614	9.610849	10.389151	10.033463	9.966537	45	11
50	30	9.577464	10.422536	9.610939	10.389061	10.033476	9.966524	30	10
51	45	9.577541	10.422459	9.611029	10.388971	10.033488	9.966512	15	9
52	13	9.577618	10.422382	9.611120	10.388880	10.033501	9.966499	47	8
53	15	9.577696	10.422304	9.611210	10.388790	10.033514	9.966486	45	7
54	30	9.577773	10.422227	9.611300	10.388700	10.033527	9.966473	30	6
55	45	9.577850	10.422150	9.611390	10.388610	10.033540	9.966460	15	5
56	14	9.577927	10.422073	9.611480	10.388520	10.033553	9.966447	46	4
57	15	9.578005	10.421995	9.611570	10.388430	10.033566	9.966434	45	3
58	30	9.578082	10.421918	9.611661	10.388339	10.033579	9.966421	30	2
59	45	9.578159	10.421841	9.611751	10.388249	10.033592	9.966408	15	1
60	15	9.578236	10.421764	9.611841	10.388159	10.033605	9.966395	45	0
sec.	"	cosine	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

1 ^h 29 ^m		LOG. SINES, &c. (t.)					22 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	sec.
0	15	9.578236	10.421764	9.611841	10.388159	10.033605	9.966395	45
1	15	9.578314	10.421686	9.611931	10.388069	10.033618	9.966382	45
2	30	9.578391	10.421609	9.612021	10.387979	10.033630	9.966370	30
3	45	9.578468	10.421532	9.612111	10.387889	10.033643	9.966357	15
4	16	9.578545	10.421455	9.612201	10.387799	10.033656	9.966344	44
5	15	9.578622	10.421378	9.612291	10.387709	10.033669	9.966331	45
6	30	9.578699	10.421301	9.612381	10.387619	10.033682	9.966318	30
7	45	9.578776	10.421224	9.612471	10.387529	10.033695	9.966305	15
8	17	9.578853	10.421147	9.612561	10.387439	10.033708	9.966292	43
9	15	9.578930	10.421070	9.612651	10.387349	10.033721	9.966279	45
10	30	9.579008	10.420992	9.612741	10.387259	10.033734	9.966266	30
11	45	9.579085	10.420915	9.612831	10.387169	10.033747	9.966253	15
12	18	9.579162	10.420838	9.612921	10.387079	10.033760	9.966240	42
13	15	9.579239	10.420761	9.613011	10.386989	10.033773	9.966227	45
14	30	9.579316	10.420684	9.613101	10.386899	10.033786	9.966214	30
15	45	9.579393	10.420607	9.613191	10.386809	10.033799	9.966201	15
16	19	9.579469	10.420531	9.613281	10.386719	10.033812	9.966188	41
17	15	9.579546	10.420454	9.613371	10.386629	10.033825	9.966175	45
18	30	9.579623	10.420377	9.613461	10.386539	10.033838	9.966162	30
19	45	9.579700	10.420300	9.613551	10.386449	10.033851	9.966149	15
20	20	9.579777	10.420223	9.613641	10.386359	10.033864	9.966136	40
21	15	9.579854	10.420146	9.613730	10.386270	10.033877	9.966123	45
22	30	9.579931	10.420069	9.613820	10.386180	10.033890	9.966110	30
23	45	9.580008	10.419992	9.613910	10.386090	10.033903	9.966097	15
24	21	9.580084	10.419916	9.614000	10.386000	10.033915	9.966085	39
25	15	9.580161	10.419839	9.614090	10.385910	10.033928	9.966072	45
26	30	9.580238	10.419762	9.614180	10.385820	10.033941	9.966059	30
27	45	9.580315	10.419685	9.614269	10.385731	10.033954	9.966046	15
28	22	9.580392	10.419608	9.614359	10.385641	10.033967	9.966033	38
29	15	9.580468	10.419532	9.614449	10.385551	10.033980	9.966020	45
30	30	9.580545	10.419455	9.614539	10.385461	10.033993	9.966007	30
31	45	9.580622	10.419378	9.614628	10.385372	10.034006	9.965994	15
32	23	9.580699	10.419301	9.614718	10.385282	10.034019	9.965981	37
33	15	9.580775	10.419225	9.614808	10.385192	10.034032	9.965968	45
34	30	9.580852	10.419148	9.614897	10.385103	10.034045	9.965955	30
35	45	9.580929	10.419071	9.614987	10.385013	10.034058	9.965942	15
36	24	9.581005	10.418995	9.615077	10.384923	10.034072	9.965928	36
37	15	9.581082	10.418918	9.615166	10.384834	10.034085	9.965915	45
38	30	9.581158	10.418842	9.615256	10.384744	10.034098	9.965902	30
39	45	9.581235	10.418765	9.615345	10.384655	10.034111	9.965889	15
40	25	9.581312	10.418688	9.615435	10.384565	10.034124	9.965876	35
41	15	9.581388	10.418612	9.615525	10.384475	10.034137	9.965863	45
42	30	9.581465	10.418535	9.615614	10.384386	10.034150	9.965850	30
43	45	9.581541	10.418459	9.615704	10.384296	10.034163	9.965837	15
44	26	9.581618	10.418382	9.615793	10.384207	10.034176	9.965824	34
45	15	9.581694	10.418306	9.615883	10.384117	10.034189	9.965811	45
46	30	9.581771	10.418229	9.615972	10.384028	10.034202	9.965798	30
47	45	9.581847	10.418153	9.616062	10.383938	10.034215	9.965785	15
48	27	9.581924	10.418076	9.616151	10.383849	10.034228	9.965772	33
49	15	9.582000	10.418000	9.616241	10.383759	10.034241	9.965759	45
50	30	9.582076	10.417924	9.616330	10.383670	10.034254	9.965746	30
51	45	9.582153	10.417847	9.616420	10.383580	10.034267	9.965733	15
52	28	9.582229	10.417771	9.616509	10.383491	10.034280	9.965720	32
53	15	9.582305	10.417695	9.616599	10.383401	10.034293	9.965707	45
54	30	9.582382	10.417618	9.616688	10.383312	10.034306	9.965694	30
55	45	9.582458	10.417542	9.616777	10.383223	10.034319	9.965681	15
56	29	9.582534	10.417466	9.616867	10.383133	10.034332	9.965668	31
57	15	9.582611	10.417389	9.616956	10.383044	10.034345	9.965655	45
58	30	9.582687	10.417313	9.617046	10.382954	10.034359	9.965641	30
59	45	9.582763	10.417237	9.617135	10.382865	10.034372	9.965628	15
60	30	9.582840	10.417160	9.617224	10.382776	10.034385	9.965615	30
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	sec.
4 ^h 30 ^m		LOG. SINES, &c.					67 deg.	

1 ^h 30 ^m .		LOG. SINES, &c. (t.)						22 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.582840	10.417160	9.617224	10.382776	10.034385	9.965615	30	60
1	15	9.582916	10.417084	9.617314	10.382686	10.034393	9.965602	45	59
2	30	9.582992	10.417008	9.617403	10.382597	10.034411	9.965589	30	58
3	45	9.583068	10.416932	9.617492	10.382508	10.034424	9.965576	15	57
4	31	9.583144	10.416856	9.617581	10.382419	10.034437	9.965563	29	56
5	15	9.583221	10.416779	9.617671	10.382329	10.034450	9.965550	45	55
6	30	9.583297	10.416703	9.617760	10.382240	10.034463	9.965537	30	54
7	45	9.583373	10.416627	9.617849	10.382151	10.034476	9.965524	15	53
8	32	9.583449	10.416551	9.617938	10.382062	10.034489	9.965511	28	52
9	15	9.583525	10.416475	9.618028	10.381972	10.034503	9.965497	45	51
10	30	9.583601	10.416399	9.618117	10.381883	10.034516	9.965484	30	50
11	45	9.583677	10.416323	9.618206	10.381794	10.034529	9.965471	15	49
12	33	9.583753	10.416247	9.618295	10.381705	10.034542	9.965458	27	48
13	15	9.583830	10.416170	9.618384	10.381616	10.034555	9.965445	45	47
14	30	9.583906	10.416094	9.618474	10.381526	10.034568	9.965432	30	46
15	45	9.583982	10.416018	9.618563	10.381437	10.034581	9.965419	15	45
16	34	9.584058	10.415942	9.618652	10.381348	10.034594	9.965406	26	44
17	15	9.584134	10.415866	9.618741	10.381259	10.034607	9.965393	45	43
18	30	9.584210	10.415790	9.618830	10.381170	10.034621	9.965379	30	42
19	45	9.584285	10.415715	9.618919	10.381081	10.034634	9.965366	15	41
20	35	9.584361	10.415639	9.619008	10.380992	10.034647	9.965353	25	40
21	15	9.584437	10.415563	9.619097	10.380903	10.034660	9.965340	45	39
22	30	9.584513	10.415487	9.619186	10.380814	10.034673	9.965327	30	38
23	45	9.584589	10.415411	9.619275	10.380725	10.034686	9.965314	15	37
24	36	9.584665	10.415335	9.619364	10.380636	10.034699	9.965301	24	36
25	15	9.584741	10.415259	9.619453	10.380547	10.034713	9.965287	45	35
26	30	9.584817	10.415183	9.619542	10.380458	10.034726	9.965274	30	34
27	45	9.584893	10.415107	9.619631	10.380369	10.034739	9.965261	15	33
28	37	9.584968	10.415032	9.619720	10.380280	10.034752	9.965248	23	32
29	15	9.585044	10.414956	9.619809	10.380191	10.034765	9.965235	45	31
30	30	9.585120	10.414880	9.619898	10.380102	10.034778	9.965222	30	30
31	45	9.585196	10.414804	9.619987	10.380013	10.034792	9.965208	15	29
32	38	9.585272	10.414728	9.620076	10.379924	10.034805	9.965195	22	28
33	15	9.585347	10.414653	9.620165	10.379835	10.034818	9.965182	45	27
34	30	9.585423	10.414577	9.620254	10.379746	10.034831	9.965169	30	26
35	45	9.585499	10.414501	9.620343	10.379657	10.034844	9.965156	15	25
36	39	9.585574	10.414426	9.620432	10.379568	10.034857	9.965143	21	24
37	15	9.585650	10.414350	9.620521	10.379479	10.034871	9.965129	45	23
38	30	9.585726	10.414274	9.620609	10.379391	10.034884	9.965116	30	22
39	45	9.585801	10.414199	9.620698	10.379302	10.034897	9.965103	15	21
40	40	9.585877	10.414123	9.620787	10.379213	10.034910	9.965090	20	20
41	15	9.585953	10.414047	9.620876	10.379124	10.034923	9.965077	45	19
42	30	9.586028	10.413972	9.620965	10.379035	10.034937	9.965064	30	18
43	45	9.586104	10.413896	9.621054	10.378946	10.034950	9.965050	15	17
44	41	9.586179	10.413821	9.621142	10.378858	10.034963	9.965037	19	16
45	15	9.586255	10.413745	9.621231	10.378769	10.034976	9.965024	45	15
46	30	9.586330	10.413670	9.621320	10.378680	10.034989	9.965011	30	14
47	45	9.586406	10.413594	9.621409	10.378591	10.035003	9.964997	15	13
48	42	9.586482	10.413518	9.621497	10.378503	10.035016	9.964984	18	12
49	15	9.586557	10.413443	9.621586	10.378414	10.035029	9.964971	45	11
50	30	9.586632	10.413368	9.621675	10.378325	10.035042	9.964958	30	10
51	45	9.586708	10.413292	9.621763	10.378237	10.035055	9.964945	15	9
52	43	9.586783	10.413217	9.621852	10.378148	10.035069	9.964931	17	8
53	15	9.586859	10.413141	9.621941	10.378059	10.035082	9.964918	45	7
54	30	9.586934	10.413066	9.622029	10.377971	10.035095	9.964905	30	6
55	45	9.587010	10.412990	9.622118	10.377882	10.035108	9.964892	15	5
56	44	9.587085	10.412915	9.622207	10.377793	10.035122	9.964878	16	4
57	15	9.587160	10.412840	9.622295	10.377705	10.035135	9.964865	45	3
58	30	9.587236	10.412764	9.622384	10.377616	10.035148	9.964852	30	2
59	45	9.587311	10.412689	9.622472	10.377528	10.035161	9.964839	15	1
60	45	9.587386	10.412614	9.622561	10.377439	10.035174	9.964826	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 29 ^m .		LOG. SINES, &c.						67 deg.	

1 ^h 31 ^m .		LOG. SINES, &c. (t.)						22 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.587386	10.412614	9.622561	10.377439	10.035174	9.964826	15	60
1	15	9.587462	10.412538	9.622649	10.377351	10.035188	9.964812	45	59
2	30	9.587537	10.412463	9.622738	10.377262	10.035201	9.964799	30	58
3	45	9.587612	10.412388	9.622826	10.377174	10.035214	9.964786	15	57
4	46	9.587688	10.412312	9.622915	10.377085	10.035227	9.964773	14	56
5	15	9.587763	10.412237	9.623003	10.376997	10.035241	9.964759	45	55
6	30	9.587838	10.412162	9.623092	10.376908	10.035254	9.964746	30	54
7	45	9.587913	10.412087	9.623180	10.376820	10.035267	9.964733	15	53
8	47	9.587988	10.412012	9.623269	10.376731	10.035281	9.964719	13	52
9	15	9.588064	10.411936	9.623357	10.376643	10.035294	9.964706	45	51
10	30	9.588139	10.411861	9.623446	10.376554	10.035307	9.964693	30	50
11	45	9.588214	10.411786	9.623534	10.376466	10.035320	9.964680	15	49
12	48	9.588289	10.411711	9.623623	10.376377	10.035334	9.964666	12	48
13	15	9.588364	10.411636	9.623711	10.376289	10.035347	9.964653	45	47
14	30	9.588439	10.411561	9.623799	10.376201	10.035360	9.964640	30	46
15	45	9.588514	10.411486	9.623888	10.376112	10.035373	9.964627	15	45
16	49	9.588590	10.411410	9.623976	10.376024	10.035387	9.964613	11	44
17	15	9.588665	10.411335	9.624065	10.375935	10.035400	9.964600	45	43
18	30	9.588740	10.411260	9.624153	10.375847	10.035413	9.964587	30	42
19	45	9.588815	10.411185	9.624241	10.375759	10.035427	9.964573	15	41
20	50	9.588890	10.411110	9.624330	10.375670	10.035440	9.964560	10	40
21	15	9.588965	10.411035	9.624418	10.375582	10.035453	9.964547	45	39
22	30	9.589040	10.410960	9.624506	10.375494	10.035466	9.964534	30	38
23	45	9.589115	10.410885	9.624594	10.375406	10.035480	9.964520	15	37
24	51	9.589190	10.410810	9.624683	10.375317	10.035493	9.964507	9	36
25	15	9.589265	10.410735	9.624771	10.375229	10.035506	9.964494	45	35
26	30	9.589339	10.410661	9.624859	10.375141	10.035520	9.964480	30	34
27	45	9.589414	10.410586	9.624947	10.375053	10.035533	9.964467	15	33
28	52	9.589489	10.410511	9.625036	10.374964	10.035546	9.964454	8	32
29	15	9.589564	10.410436	9.625124	10.374876	10.035560	9.964440	45	31
30	30	9.589639	10.410361	9.625212	10.374788	10.035573	9.964427	30	30
31	45	9.589714	10.410286	9.625300	10.374700	10.035586	9.964414	15	29
32	53	9.589789	10.410211	9.625388	10.374612	10.035600	9.964400	7	28
33	15	9.589864	10.410136	9.625476	10.374524	10.035613	9.964387	45	27
34	30	9.589939	10.410062	9.625565	10.374435	10.035626	9.964374	30	26
35	45	9.590013	10.409987	9.625653	10.374347	10.035640	9.964360	15	25
36	54	9.590088	10.409912	9.625741	10.374259	10.035653	9.964347	6	24
37	15	9.590163	10.409837	9.625829	10.374171	10.035666	9.964334	45	23
38	30	9.590237	10.409763	9.625917	10.374083	10.035680	9.964320	30	22
39	45	9.590312	10.409688	9.626005	10.373995	10.035693	9.964307	15	21
40	55	9.590387	10.409613	9.626093	10.373907	10.035706	9.964294	5	20
41	15	9.590462	10.409538	9.626181	10.373819	10.035720	9.964280	45	19
42	30	9.590536	10.409464	9.626269	10.373731	10.035733	9.964267	30	18
43	45	9.590611	10.409389	9.626357	10.373643	10.035746	9.964254	15	17
44	56	9.590686	10.409314	9.626445	10.373555	10.035760	9.964240	4	16
45	15	9.590760	10.409240	9.626533	10.373467	10.035773	9.964227	45	15
46	30	9.590835	10.409165	9.626621	10.373379	10.035787	9.964213	30	14
47	45	9.590909	10.409091	9.626709	10.373291	10.035800	9.964200	15	13
48	57	9.590984	10.409016	9.626797	10.373203	10.035813	9.964187	3	12
49	15	9.591059	10.408941	9.626885	10.373115	10.035827	9.964173	45	11
50	30	9.591133	10.408867	9.626973	10.373027	10.035840	9.964160	30	10
51	45	9.591208	10.408792	9.627061	10.372939	10.035853	9.964147	15	9
52	58	9.591282	10.408718	9.627149	10.372851	10.035867	9.964133	2	8
53	15	9.591357	10.408643	9.627237	10.372763	10.035880	9.964120	45	7
54	30	9.591431	10.408569	9.627325	10.372675	10.035894	9.964106	30	6
55	45	9.591506	10.408494	9.627413	10.372587	10.035907	9.964093	15	5
56	59	9.591580	10.408420	9.627501	10.372499	10.035920	9.964080	1	4
57	15	9.591655	10.408345	9.627588	10.372412	10.035934	9.964066	45	3
58	30	9.591729	10.408271	9.627676	10.372324	10.035947	9.964053	30	2
59	45	9.591804	10.408196	9.627764	10.372236	10.035961	9.964039	15	1
60	60	9.591878	10.408122	9.627852	10.372148	10.035974	9.964026	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

4^h 28^m.

LOG. SINES, &c.

67 deg.

1 ^h 32 ^m .		LOG. SINES, &c. (t.)						23 deg.	
sec.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.		sec.
0	0	9.591878	10.408122	9.627852	10.372148	10.035974	9.964026	60	00
1	15	9.591952	10.408048	9.627940	10.372060	10.035987	9.964013	45	59
2	30	9.592027	10.407973	9.628027	10.371973	10.036001	9.963999	30	58
3	45	9.592101	10.407899	9.628115	10.371885	10.036014	9.963986	15	57
4	1	9.592175	10.407825	9.628203	10.371797	10.036028	9.963972	59	56
5	15	9.592250	10.407750	9.628291	10.371709	10.036041	9.963959	45	55
6	30	9.592324	10.407676	9.628379	10.371621	10.036054	9.963946	30	54
7	45	9.592398	10.407602	9.628466	10.371534	10.036068	9.963932	15	53
8	2	9.592473	10.407527	9.628554	10.371446	10.036081	9.963919	58	52
9	15	9.592547	10.407453	9.628642	10.371358	10.036095	9.963905	45	51
10	30	9.592621	10.407379	9.628729	10.371271	10.036108	9.963892	30	50
11	45	9.592696	10.407304	9.628817	10.371183	10.036122	9.963878	15	49
12	3	9.592770	10.407230	9.628905	10.371095	10.036135	9.963865	57	48
13	15	9.592844	10.407156	9.628992	10.371008	10.036148	9.963852	45	47
14	30	9.592918	10.407082	9.629080	10.370920	10.036162	9.963838	30	46
15	45	9.592992	10.407008	9.629168	10.370832	10.036175	9.963825	15	45
16	4	9.593067	10.406933	9.629255	10.370745	10.036189	9.963811	56	44
17	15	9.593141	10.406859	9.629343	10.370657	10.036202	9.963798	45	43
18	30	9.593215	10.406785	9.629430	10.370570	10.036216	9.963784	30	42
19	45	9.593289	10.406711	9.629518	10.370482	10.036229	9.963771	15	41
20	5	9.593363	10.406637	9.629606	10.370394	10.036243	9.963757	55	40
21	15	9.593437	10.406563	9.629693	10.370307	10.036256	9.963744	45	39
22	30	9.593511	10.406489	9.629781	10.370219	10.036270	9.963730	30	38
23	45	9.593585	10.406415	9.629868	10.370132	10.036283	9.963717	15	37
24	6	9.593659	10.406341	9.629956	10.370044	10.036296	9.963704	54	36
25	15	9.593733	10.406267	9.630043	10.369957	10.036310	9.963690	45	35
26	30	9.593807	10.406193	9.630131	10.369869	10.036323	9.963677	30	34
27	45	9.593881	10.406119	9.630218	10.369782	10.036337	9.963663	15	33
28	7	9.593955	10.406045	9.630306	10.369694	10.036350	9.963650	53	32
29	15	9.594029	10.405971	9.630393	10.369607	10.036364	9.963636	45	31
30	30	9.594103	10.405897	9.630481	10.369519	10.036377	9.963623	30	30
31	45	9.594177	10.405823	9.630568	10.369432	10.036391	9.963609	15	29
32	8	9.594251	10.405749	9.630656	10.369344	10.036404	9.963596	52	28
33	15	9.594325	10.405675	9.630743	10.369257	10.036418	9.963582	45	27
34	30	9.594399	10.405601	9.630830	10.369170	10.036431	9.963569	30	26
35	45	9.594473	10.405527	9.630918	10.369082	10.036445	9.963555	15	25
36	9	9.594547	10.405453	9.631005	10.368995	10.036458	9.963542	51	24
37	15	9.594621	10.405379	9.631092	10.368908	10.036472	9.963528	45	23
38	30	9.594695	10.405305	9.631180	10.368820	10.036485	9.963515	30	22
39	45	9.594768	10.405232	9.631267	10.368733	10.036499	9.963501	15	21
40	10	9.594842	10.405158	9.631354	10.368646	10.036512	9.963488	50	20
41	15	9.594916	10.405084	9.631442	10.368558	10.036526	9.963474	45	19
42	30	9.594990	10.405010	9.631529	10.368471	10.036539	9.963461	30	18
43	45	9.595064	10.404936	9.631616	10.368384	10.036553	9.963447	15	17
44	11	9.595137	10.404863	9.631704	10.368296	10.036566	9.963434	49	16
45	15	9.595211	10.404789	9.631791	10.368209	10.036580	9.963420	45	15
46	30	9.595285	10.404715	9.631878	10.368122	10.036594	9.963406	30	14
47	45	9.595358	10.404642	9.631965	10.368035	10.036607	9.963393	15	13
48	12	9.595432	10.404568	9.632053	10.367947	10.036621	9.963379	48	12
49	15	9.595506	10.404494	9.632140	10.367860	10.036634	9.963366	45	11
50	30	9.595579	10.404421	9.632227	10.367773	10.036648	9.963352	30	10
51	45	9.595653	10.404347	9.632314	10.367686	10.036661	9.963339	15	9
52	13	9.595727	10.404273	9.632401	10.367599	10.036675	9.963325	47	8
53	15	9.595800	10.404200	9.632489	10.367511	10.036688	9.963312	45	7
54	30	9.595874	10.404126	9.632576	10.367424	10.036702	9.963298	30	6
55	45	9.595948	10.404052	9.632663	10.367337	10.036715	9.963285	15	5
56	14	9.596021	10.403979	9.632750	10.367250	10.036729	9.963271	46	4
57	15	9.596095	10.403905	9.632837	10.367163	10.036743	9.963257	45	3
58	30	9.596168	10.403832	9.632924	10.367076	10.036756	9.963244	30	2
59	45	9.596242	10.403758	9.633011	10.366989	10.036770	9.963230	15	1
60	15	9.596315	10.403685	9.633098	10.366902	10.036783	9.963217	45	0
sec.		cosine.	secant.	cotangent.	tangent.	cosecant.	sine.		sec.

4^h 27^m.

LOG. SINES, &c.

66 deg.

1 ^h 33 ^m .		LOG. SINES, &c. (t.)						23 deg.		
sec.	"	sine	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	15	9.596315	10.403685	9.633098	10.366902	10.036783	9.963217	45		60
1	15	9.596389	10.403611	9.633186	10.366814	10.036797	9.963203	45		59
2	30	9.596462	10.403538	9.633273	10.366727	10.036810	9.963190	30		58
3	45	9.596536	10.403464	9.633360	10.366640	10.036824	9.963176	15		57
4	16	9.596609	10.403391	9.633447	10.366553	10.036838	9.963162	44		56
5	15	9.596683	10.403317	9.633534	10.366466	10.036851	9.963149	45		55
6	30	9.596756	10.403244	9.633621	10.366379	10.036865	9.963135	30		54
7	45	9.596830	10.403170	9.633708	10.366292	10.036878	9.963122	15		53
8	17	9.596903	10.403097	9.633795	10.366205	10.036892	9.963108	43		52
9	15	9.596976	10.403024	9.633882	10.366118	10.036905	9.963095	45		51
10	30	9.597050	10.402950	9.633969	10.366031	10.036919	9.963081	30		50
11	45	9.597123	10.402877	9.634056	10.365944	10.036933	9.963067	15		49
12	18	9.597196	10.402804	9.634143	10.365857	10.036946	9.963054	42		48
13	15	9.597270	10.402730	9.634230	10.365770	10.036960	9.963040	45		47
14	30	9.597343	10.402657	9.634316	10.365684	10.036973	9.963027	30		46
15	45	9.597416	10.402584	9.634403	10.365597	10.036987	9.963013	15		45
16	19	9.597490	10.402510	9.634490	10.365510	10.037001	9.962999	41		44
17	15	9.597563	10.402437	9.634577	10.365423	10.037014	9.962986	45		43
18	30	9.597636	10.402364	9.634664	10.365336	10.037028	9.962972	30		42
19	45	9.597709	10.402291	9.634751	10.365249	10.037042	9.962958	15		41
20	20	9.597783	10.402217	9.634838	10.365162	10.037055	9.962945	40		40
21	15	9.597856	10.402144	9.634925	10.365075	10.037069	9.962931	45		39
22	30	9.597929	10.402071	9.635011	10.364989	10.037082	9.962918	30		38
23	45	9.598002	10.401998	9.635098	10.364902	10.037096	9.962904	15		37
24	21	9.598075	10.401925	9.635185	10.364815	10.037110	9.962890	39		36
25	15	9.598149	10.401851	9.635272	10.364728	10.037123	9.962877	45		35
26	30	9.598222	10.401778	9.635359	10.364641	10.037137	9.962863	30		34
27	45	9.598295	10.401705	9.635445	10.364555	10.037151	9.962849	15		33
28	22	9.598368	10.401632	9.635532	10.364468	10.037164	9.962836	38		32
29	15	9.598441	10.401559	9.635619	10.364381	10.037178	9.962822	45		31
30	30	9.598514	10.401486	9.635706	10.364294	10.037192	9.962808	30		30
31	45	9.598587	10.401413	9.635792	10.364208	10.037205	9.962795	15		29
32	23	9.598660	10.401340	9.635879	10.364121	10.037219	9.962781	37		28
33	15	9.598733	10.401267	9.635966	10.364034	10.037232	9.962768	45		27
34	30	9.598806	10.401194	9.636052	10.363948	10.037246	9.962754	30		26
35	45	9.598879	10.401121	9.636139	10.363861	10.037260	9.962740	15		25
36	24	9.598952	10.401048	9.636226	10.363774	10.037273	9.962727	36		24
37	15	9.599025	10.400975	9.636312	10.363688	10.037287	9.962713	45		23
38	30	9.599098	10.400902	9.636399	10.363601	10.037301	9.962699	30		22
39	45	9.599171	10.400829	9.636486	10.363514	10.037314	9.962686	15		21
40	25	9.599244	10.400756	9.636572	10.363428	10.037328	9.962672	35		20
41	15	9.599317	10.400683	9.636659	10.363341	10.037342	9.962658	45		19
42	30	9.599390	10.400610	9.636745	10.363255	10.037356	9.962644	30		18
43	45	9.599463	10.400537	9.636832	10.363168	10.037369	9.962631	15		17
44	26	9.599536	10.400464	9.636918	10.363082	10.037383	9.962617	34		16
45	15	9.599608	10.400392	9.637005	10.362995	10.037397	9.962603	45		15
46	30	9.599681	10.400319	9.637092	10.362908	10.037410	9.962590	30		14
47	45	9.599754	10.400246	9.637178	10.362822	10.037424	9.962576	15		13
48	27	9.599827	10.400173	9.637265	10.362735	10.037438	9.962562	33		12
49	15	9.599900	10.400100	9.637351	10.362649	10.037451	9.962549	45		11
50	30	9.599973	10.400027	9.637438	10.362562	10.037465	9.962535	30		10
51	45	9.600045	10.399955	9.637524	10.362476	10.037479	9.962521	15		9
52	28	9.600118	10.399882	9.637611	10.362389	10.037492	9.962508	32		8
53	15	9.600191	10.399809	9.637697	10.362303	10.037506	9.962494	45		7
54	30	9.600264	10.399736	9.637783	10.362217	10.037520	9.962480	30		6
55	45	9.600336	10.399664	9.637870	10.362130	10.037534	9.962466	15		5
56	29	9.600409	10.399591	9.637956	10.362044	10.037547	9.962453	31		4
57	15	9.600482	10.399518	9.638043	10.361957	10.037561	9.962439	45		3
58	30	9.600554	10.399446	9.638129	10.361871	10.037575	9.962425	30		2
59	45	9.600627	10.399373	9.638215	10.361785	10.037589	9.962411	15		1
60	30	9.600700	10.399300	9.638302	10.361698	10.037602	9.962398	30		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
4 ^h 26 ^m .		LOG. SINES, &c.						66 deg.		

1 ^h 34 ^m .				LOG. SINES, &c. (t.)				23 deg.			
sec.	'	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0	30		9.600700	10.399300	9.638302	10.361698	10.037602	9.962398	30		60
1		15	9.600772	10.399228	9.638388	10.361612	10.037616	9.962384	45		59
2		30	9.600845	10.399155	9.638475	10.361525	10.037630	9.962370	30		58
3		45	9.600917	10.399083	9.638561	10.361439	10.037643	9.962357	15		57
4	31		9.600990	10.399010	9.638647	10.361353	10.037657	9.962343		29	56
5		15	9.601063	10.398937	9.638734	10.361266	10.037671	9.962329	45		55
6		30	9.601135	10.398865	9.638820	10.361180	10.037685	9.962315	30		54
7		45	9.601208	10.398792	9.638906	10.361094	10.037698	9.962302	15		53
8	32		9.601280	10.398720	9.638992	10.361008	10.037712	9.962288		28	52
9		15	9.601353	10.398647	9.639079	10.360921	10.037726	9.962274	45		51
10		30	9.601425	10.398575	9.639165	10.360835	10.037740	9.962260	30		50
11		45	9.601498	10.398502	9.639251	10.360749	10.037753	9.962247	15		49
12	33		9.601570	10.398430	9.639337	10.360663	10.037767	9.962233		27	48
13		15	9.601643	10.398357	9.639424	10.360576	10.037781	9.962219	45		47
14		30	9.601715	10.398285	9.639510	10.360490	10.037795	9.962205	30		46
15		45	9.601788	10.398212	9.639596	10.360404	10.037809	9.962191	15		45
16	34		9.601860	10.398140	9.639682	10.360318	10.037822	9.962178		26	44
17		15	9.601932	10.398068	9.639768	10.360232	10.037836	9.962164	45		43
18		30	9.602005	10.397995	9.639855	10.360145	10.037850	9.962150	30		42
19		45	9.602077	10.397923	9.639941	10.360059	10.037864	9.962136	15		41
20	35		9.602149	10.397851	9.640027	10.359973	10.037877	9.962123		25	40
21		15	9.602222	10.397778	9.640113	10.359887	10.037891	9.962109	45		39
22		30	9.602294	10.397706	9.640199	10.359801	10.037905	9.962095	30		38
23		45	9.602366	10.397634	9.640285	10.359715	10.037919	9.962081	15		37
24	36		9.602439	10.397561	9.640371	10.359629	10.037933	9.962067		24	36
25		15	9.602511	10.397489	9.640457	10.359543	10.037946	9.962054	45		35
26		30	9.602583	10.397417	9.640543	10.359457	10.037960	9.962040	30		34
27		45	9.602656	10.397344	9.640630	10.359370	10.037974	9.962026	15		33
28	37		9.602728	10.397272	9.640716	10.359284	10.037988	9.962012		23	32
29		15	9.602800	10.397200	9.640802	10.359198	10.038002	9.961998	45		31
30		30	9.602872	10.397128	9.640888	10.359112	10.038015	9.961985	30		30
31		45	9.602944	10.397056	9.640974	10.359026	10.038029	9.961971	15		29
32	38		9.603017	10.396983	9.641060	10.358940	10.038043	9.961957		22	28
33		15	9.603089	10.396911	9.641146	10.358854	10.038057	9.961943	45		27
34		30	9.603161	10.396839	9.641232	10.358768	10.038071	9.961929	30		26
35		45	9.603233	10.396767	9.641318	10.358682	10.038085	9.961915	15		25
36	39		9.603305	10.396695	9.641404	10.358596	10.038098	9.961902		21	24
37		15	9.603377	10.396623	9.641489	10.358511	10.038112	9.961888	45		23
38		30	9.603449	10.396551	9.641575	10.358425	10.038126	9.961874	30		22
39		45	9.603521	10.396479	9.641661	10.358339	10.038140	9.961860	15		21
40	40		9.603594	10.396406	9.641747	10.358253	10.038154	9.961846		20	20
41		15	9.603666	10.396334	9.641833	10.358167	10.038168	9.961832	45		19
42		30	9.603738	10.396262	9.641919	10.358081	10.038181	9.961819	30		18
43		45	9.603810	10.396190	9.642005	10.357995	10.038195	9.961805	15		17
44	41		9.603882	10.396118	9.642091	10.357909	10.038209	9.961791		19	16
45		15	9.603954	10.396046	9.642177	10.357823	10.038223	9.961777	45		15
46		30	9.604026	10.395974	9.642262	10.357738	10.038237	9.961763	30		14
47		45	9.604098	10.395902	9.642348	10.357652	10.038251	9.961749	15		13
48	42		9.604170	10.395830	9.642434	10.357566	10.038265	9.961735		18	12
49		15	9.604242	10.395758	9.642520	10.357480	10.038278	9.961722	45		11
50		30	9.604313	10.395687	9.642606	10.357394	10.038292	9.961708	30		10
51		45	9.604385	10.395615	9.642691	10.357309	10.038306	9.961694	15		9
52	43		9.604457	10.395543	9.642777	10.357223	10.038320	9.961680		17	8
53		15	9.604529	10.395471	9.642863	10.357137	10.038334	9.961666	45		7
54		30	9.604601	10.395399	9.642949	10.357051	10.038348	9.961652	30		6
55		45	9.604673	10.395327	9.643035	10.356965	10.038362	9.961638	15		5
56	44		9.604745	10.395255	9.643120	10.356880	10.038376	9.961624		16	4
57		15	9.604817	10.395183	9.643206	10.356794	10.038389	9.961611	45		3
58		30	9.604888	10.395112	9.643292	10.356708	10.038403	9.961597	30		2
59		45	9.604960	10.395040	9.643377	10.356623	10.038417	9.961583	15		1
60	45		9.605032	10.394968	9.643463	10.356537	10.038431	9.961569		15	0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.
4 ^h 25 ^m .				LOG. SINES, &c.				66 deg.			

1 ^h 35 ^m .		LOG. SINES, &c. (t.)					23 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.605032	10.394968	9.643463	10.356537	10.038431	9.961569	15	60
1	15	9.605104	10.394896	9.643549	10.356451	10.038445	9.961555	45	59
2	30	9.605175	10.394825	9.643634	10.356366	10.038459	9.961541	30	58
3	45	9.605247	10.394753	9.643720	10.356280	10.038473	9.961527	15	57
4	46	9.605319	10.394681	9.643806	10.356194	10.038487	9.961513	14	56
5	15	9.605391	10.394609	9.643891	10.356109	10.038501	9.961499	45	55
6	30	9.605462	10.394538	9.643977	10.356023	10.038515	9.961485	30	54
7	45	9.605534	10.394466	9.644062	10.355938	10.038528	9.961472	15	53
8	47	9.605606	10.394394	9.644148	10.355852	10.038542	9.961458	13	52
9	15	9.605677	10.394323	9.644234	10.355766	10.038556	9.961444	45	51
10	30	9.605749	10.394251	9.644319	10.355681	10.038570	9.961430	30	50
11	45	9.605821	10.394179	9.644405	10.355595	10.038584	9.961416	15	49
12	48	9.605892	10.394108	9.644490	10.355510	10.038598	9.961402	12	48
13	15	9.605964	10.394036	9.644576	10.355424	10.038612	9.961388	45	47
14	30	9.606035	10.393965	9.644661	10.355339	10.038626	9.961374	30	46
15	45	9.606107	10.393893	9.644747	10.355253	10.038640	9.961360	15	45
16	49	9.606179	10.393821	9.644832	10.355168	10.038654	9.961346	11	44
17	15	9.606250	10.393750	9.644918	10.355082	10.038668	9.961332	45	43
18	30	9.606322	10.393678	9.645003	10.354997	10.038682	9.961318	30	42
19	45	9.606393	10.393607	9.645089	10.354911	10.038696	9.961304	15	41
20	50	9.606465	10.393535	9.645174	10.354826	10.038710	9.961290	10	40
21	15	9.606536	10.393464	9.645260	10.354740	10.038724	9.961276	45	39
22	30	9.606608	10.393392	9.645345	10.354655	10.038738	9.961262	30	38
23	45	9.606679	10.393321	9.645431	10.354569	10.038751	9.961249	15	37
24	51	9.606751	10.393249	9.645516	10.354484	10.038765	9.961235	9	36
25	15	9.606822	10.393178	9.645601	10.354399	10.038779	9.961221	45	35
26	30	9.606893	10.393107	9.645687	10.354313	10.038793	9.961207	30	34
27	45	9.606965	10.393035	9.645772	10.354228	10.038807	9.961193	15	33
28	52	9.607036	10.392964	9.645857	10.354143	10.038821	9.961179	8	32
29	15	9.607108	10.392892	9.645943	10.354057	10.038835	9.961165	45	31
30	30	9.607179	10.392821	9.646028	10.353972	10.038849	9.961151	30	30
31	45	9.607250	10.392750	9.646113	10.353887	10.038863	9.961137	15	29
32	53	9.607322	10.392678	9.646199	10.353801	10.038877	9.961123	7	28
33	15	9.607393	10.392607	9.646284	10.353716	10.038891	9.961109	45	27
34	30	9.607464	10.392536	9.646369	10.353631	10.038905	9.961095	30	26
35	45	9.607535	10.392465	9.646455	10.353545	10.038919	9.961081	15	25
36	54	9.607607	10.392393	9.646540	10.353460	10.038933	9.961067	6	24
37	15	9.607678	10.392322	9.646625	10.353375	10.038947	9.961053	45	23
38	30	9.607749	10.392251	9.646710	10.353290	10.038961	9.961039	30	22
39	45	9.607821	10.392179	9.646796	10.353204	10.038975	9.961025	15	21
40	55	9.607892	10.392108	9.646881	10.353119	10.038989	9.961011	5	20
41	15	9.607963	10.392037	9.646966	10.353034	10.039003	9.960997	45	19
42	30	9.608034	10.391966	9.647051	10.352949	10.039017	9.960983	30	18
43	45	9.608105	10.391895	9.647137	10.352863	10.039031	9.960969	15	17
44	56	9.608176	10.391824	9.647222	10.352778	10.039045	9.960955	4	16
45	15	9.608248	10.391752	9.647307	10.352693	10.039059	9.960941	45	15
46	30	9.608319	10.391681	9.647392	10.352608	10.039073	9.960927	30	14
47	45	9.608390	10.391610	9.647477	10.352523	10.039087	9.960913	15	13
48	57	9.608461	10.391539	9.647562	10.352438	10.039101	9.960899	3	12
49	15	9.608532	10.391468	9.647647	10.352353	10.039115	9.960885	45	11
50	30	9.608603	10.391397	9.647733	10.352267	10.039129	9.960871	30	10
51	45	9.608674	10.391326	9.647818	10.352182	10.039143	9.960857	15	9
52	58	9.608745	10.391255	9.647903	10.352097	10.039157	9.960843	2	8
53	15	9.608816	10.391184	9.647988	10.352012	10.039172	9.960828	45	7
54	30	9.608887	10.391113	9.648073	10.351927	10.039186	9.960814	30	6
55	45	9.608958	10.391042	9.648158	10.351842	10.039200	9.960800	15	5
56	59	9.609029	10.390971	9.648243	10.351757	10.039214	9.960786	1	4
57	15	9.609100	10.390900	9.648328	10.351672	10.039228	9.960772	45	3
58	30	9.609171	10.390829	9.648413	10.351587	10.039242	9.960758	30	2
59	45	9.609242	10.390758	9.648498	10.351502	10.039256	9.960744	15	1
60	60	9.609313	10.390687	9.648583	10.351417	10.039270	9.960730	(0)	0
sec.	"	cosine.	secant	cotangent.	tangent	coscant.	sine.	"	sec.
4 ^h 24 ^m .		LOG. SINES, &c.					66 deg.		

1 ^h 36 ^m			LOG. SINES, &c. (t.)						24 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	0	9.609313	10.390687	9.618583	10.351417	10.039270	9.960730	60		60	
1	15	9.609384	10.390616	9.648668	10.351332	10.039284	9.960716	45		59	
2	30	9.609455	10.390545	9.648753	10.351247	10.039298	9.960702	30		58	
3	45	9.609526	10.390474	9.648838	10.351162	10.039312	9.960688	15		57	
4	1	9.609597	10.390403	9.648923	10.351077	10.039326	9.960674	59		56	
5	15	9.609668	10.390332	9.649008	10.350992	10.039340	9.960660	45		55	
6	30	9.609739	10.390261	9.649093	10.350907	10.039354	9.960646	30		54	
7	45	9.609809	10.390191	9.649178	10.350822	10.039368	9.960632	15		53	
8	2	9.609880	10.390120	9.649263	10.350737	10.039382	9.960618	58		52	
9	15	9.609951	10.390049	9.649348	10.350652	10.039397	9.960603	45		51	
10	30	9.610022	10.389978	9.649433	10.350567	10.039411	9.960589	30		50	
11	45	9.610093	10.389907	9.649517	10.350483	10.039425	9.960575	15		49	
12	3	9.610163	10.389837	9.649602	10.350398	10.039439	9.960561	57		48	
13	15	9.610234	10.389766	9.649687	10.350313	10.039453	9.960547	45		47	
14	30	9.610305	10.389695	9.649772	10.350228	10.039467	9.960533	30		46	
15	45	9.610376	10.389624	9.649857	10.350143	10.039481	9.960519	15		45	
16	4	9.610446	10.389554	9.649942	10.350058	10.039495	9.960505	56		44	
17	15	9.610517	10.389483	9.650026	10.349974	10.039509	9.960491	45		43	
18	30	9.610588	10.389412	9.650111	10.349889	10.039523	9.960477	30		42	
19	45	9.610659	10.389341	9.650196	10.349804	10.039538	9.960462	15		41	
20	5	9.610729	10.389271	9.650281	10.349719	10.039552	9.960448	55		40	
21	15	9.610800	10.389200	9.650366	10.349634	10.039566	9.960434	45		39	
22	30	9.610870	10.389130	9.650450	10.349550	10.039580	9.960420	30		38	
23	45	9.610941	10.389059	9.650535	10.349465	10.039594	9.960406	15		37	
24	6	9.611012	10.388988	9.650620	10.349380	10.039608	9.960392	54		36	
25	15	9.611082	10.388918	9.650705	10.349295	10.039622	9.960378	45		35	
26	30	9.611153	10.388847	9.650789	10.349211	10.039636	9.960364	30		34	
27	45	9.611223	10.388777	9.650874	10.349126	10.039651	9.960349	15		33	
28	7	9.611294	10.388706	9.650959	10.349041	10.039665	9.960335	53		32	
29	15	9.611365	10.388635	9.651043	10.348957	10.039679	9.960321	45		31	
30	30	9.611435	10.388565	9.651128	10.348872	10.039693	9.960307	30		30	
31	45	9.611506	10.388494	9.651213	10.348787	10.039707	9.960293	15		29	
32	8	9.611576	10.388424	9.651297	10.348703	10.039721	9.960279	52		28	
33	15	9.611647	10.388353	9.651382	10.348618	10.039735	9.960265	45		27	
34	30	9.611717	10.388283	9.651467	10.348533	10.039750	9.960250	30		26	
35	45	9.611788	10.388212	9.651551	10.348449	10.039764	9.960236	15		25	
36	9	9.611858	10.388142	9.651636	10.348364	10.039778	9.960222	51		24	
37	15	9.611928	10.388072	9.651720	10.348280	10.039792	9.960208	45		23	
38	30	9.611999	10.388001	9.651805	10.348195	10.039806	9.960194	30		22	
39	45	9.612069	10.387931	9.651890	10.348110	10.039820	9.960180	15		21	
40	10	9.612140	10.387860	9.651974	10.348026	10.039835	9.960165	50		20	
41	15	9.612210	10.387790	9.652059	10.347941	10.039849	9.960151	45		19	
42	30	9.612280	10.387720	9.652143	10.347857	10.039863	9.960137	30		18	
43	45	9.612351	10.387649	9.652228	10.347772	10.039877	9.960123	15		17	
44	11	9.612421	10.387579	9.652312	10.347688	10.039891	9.960109	49		16	
45	15	9.612491	10.387509	9.652397	10.347603	10.039905	9.960095	45		15	
46	30	9.612562	10.387438	9.652481	10.347519	10.039920	9.960080	30		14	
47	45	9.612632	10.387368	9.652566	10.347434	10.039934	9.960066	15		13	
48	12	9.612702	10.387298	9.652650	10.347350	10.039948	9.960052	48		12	
49	15	9.612773	10.387227	9.652735	10.347265	10.039962	9.960038	45		11	
50	30	9.612843	10.387157	9.652819	10.347181	10.039976	9.960024	30		10	
51	45	9.612913	10.387087	9.652904	10.347096	10.039991	9.960009	15		9	
52	13	9.612983	10.387017	9.652988	10.347012	10.040005	9.959995	47		8	
53	15	9.613053	10.386947	9.653072	10.346928	10.040019	9.959981	45		7	
54	30	9.613124	10.386876	9.653157	10.346843	10.040033	9.959967	30		6	
55	45	9.613194	10.386806	9.653241	10.346759	10.040047	9.959953	15		5	
56	14	9.613264	10.386736	9.653326	10.346674	10.040062	9.959938	46		4	
57	15	9.613334	10.386666	9.653410	10.346590	10.040076	9.959924	45		3	
58	30	9.613404	10.386596	9.653494	10.346506	10.040090	9.959910	30		2	
59	45	9.613474	10.386526	9.653579	10.346421	10.040104	9.959896	15		1	
60	15	9.613545	10.386455	9.653663	10.346337	10.040119	9.959881	45		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
4 ^h 23 ^m			LOG. SINES, &c.				65 deg.				

1 ^h 37 ^m		LOG. SINES, &c. (t.)						24 deg.	
sec.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.		sec.
0	15	9.613545	10.386455	9.653663	10.346337	10.040119	9.959881	45	60
1	15	9.613615	10.386385	9.653747	10.346253	10.040133	9.959867	45	59
2	30	9.613685	10.386315	9.653832	10.346168	10.040147	9.959853	30	58
3	45	9.613755	10.386245	9.653916	10.346084	10.040161	9.959839	15	57
4	16	9.613825	10.386175	9.654000	10.346000	10.040175	9.959825	44	56
5	15	9.613895	10.386105	9.654085	10.345915	10.040190	9.959810	45	55
6	30	9.613965	10.386035	9.654169	10.345831	10.040204	9.959796	30	54
7	45	9.614035	10.385965	9.654253	10.345747	10.040218	9.959782	15	53
8	17	9.614105	10.385895	9.654337	10.345663	10.040232	9.959768	43	52
9	15	9.614175	10.385825	9.654422	10.345578	10.040247	9.959753	45	51
10	30	9.614245	10.385755	9.654506	10.345494	10.040261	9.959739	30	50
11	45	9.614315	10.385685	9.654590	10.345410	10.040275	9.959725	15	49
12	18	9.614385	10.385615	9.654674	10.345326	10.040289	9.959711	42	48
13	15	9.614455	10.385545	9.654759	10.345241	10.040304	9.959696	45	47
14	30	9.614525	10.385475	9.654843	10.345157	10.040318	9.959682	30	46
15	45	9.614595	10.385405	9.654927	10.345073	10.040332	9.959668	15	45
16	19	9.614665	10.385335	9.655011	10.344989	10.040347	9.959653	41	44
17	15	9.614735	10.385265	9.655095	10.344905	10.040361	9.959639	45	43
18	30	9.614804	10.385196	9.655179	10.344821	10.040375	9.959625	30	42
19	45	9.614874	10.385126	9.655264	10.344736	10.040389	9.959611	15	41
20	20	9.614944	10.385056	9.655348	10.344652	10.040404	9.959596	40	40
21	15	9.615014	10.384986	9.655432	10.344568	10.040418	9.959582	45	39
22	30	9.615084	10.384916	9.655516	10.344484	10.040432	9.959568	30	38
23	45	9.615154	10.384846	9.655600	10.344400	10.040446	9.959554	15	37
24	21	9.615223	10.384777	9.655684	10.344316	10.040461	9.959539	39	36
25	15	9.615293	10.384707	9.655768	10.344232	10.040475	9.959525	45	35
26	30	9.615363	10.384637	9.655852	10.344148	10.040489	9.959511	30	34
27	45	9.615433	10.384567	9.655936	10.344064	10.040504	9.959496	15	33
28	22	9.615502	10.384498	9.656020	10.343980	10.040518	9.959482	38	32
29	15	9.615572	10.384428	9.656104	10.343896	10.040532	9.959468	45	31
30	30	9.615642	10.384358	9.656188	10.343812	10.040547	9.959453	30	30
31	45	9.615712	10.384288	9.656272	10.343728	10.040561	9.959439	15	29
32	23	9.615781	10.384219	9.656356	10.343644	10.040575	9.959425	37	28
33	15	9.615851	10.384149	9.656440	10.343560	10.040590	9.959410	45	27
34	30	9.615921	10.384079	9.656524	10.343476	10.040604	9.959396	30	26
35	45	9.615990	10.384010	9.656608	10.343392	10.040618	9.959382	15	25
36	24	9.616060	10.383940	9.656692	10.343308	10.040633	9.959367	36	24
37	15	9.616129	10.383871	9.656776	10.343224	10.040647	9.959353	45	23
38	30	9.616199	10.383801	9.656860	10.343140	10.040661	9.959339	30	22
39	45	9.616269	10.383731	9.656944	10.343056	10.040675	9.959325	15	21
40	25	9.616338	10.383662	9.657028	10.342972	10.040690	9.959310	35	20
41	15	9.616408	10.383592	9.657112	10.342888	10.040704	9.959296	45	19
42	30	9.616477	10.383523	9.657196	10.342804	10.040719	9.959281	30	18
43	45	9.616547	10.383453	9.657280	10.342720	10.040733	9.959267	15	17
44	26	9.616616	10.383384	9.657364	10.342636	10.040747	9.959253	34	16
45	15	9.616686	10.383314	9.657447	10.342553	10.040762	9.959238	45	15
46	30	9.616755	10.383245	9.657531	10.342469	10.040776	9.959224	30	14
47	45	9.616825	10.383175	9.657615	10.342385	10.040790	9.959210	15	13
48	27	9.616894	10.383106	9.657699	10.342301	10.040805	9.959195	33	12
49	15	9.616964	10.383036	9.657783	10.342217	10.040819	9.959181	45	11
50	30	9.617033	10.382967	9.657867	10.342133	10.040833	9.959167	30	10
51	45	9.617103	10.382897	9.657950	10.342050	10.040848	9.959152	15	9
52	28	9.617172	10.382828	9.658034	10.341966	10.040862	9.959138	32	8
53	15	9.617241	10.382759	9.658118	10.341882	10.040876	9.959124	45	7
54	30	9.617311	10.382689	9.658202	10.341798	10.040891	9.959109	30	6
55	45	9.617380	10.382620	9.658285	10.341715	10.040905	9.959095	15	5
56	29	9.617450	10.382550	9.658369	10.341631	10.040920	9.959080	31	4
57	15	9.617519	10.382481	9.658453	10.341547	10.040934	9.959066	45	3
58	30	9.617588	10.382412	9.658537	10.341463	10.040948	9.959052	30	2
59	45	9.617658	10.382342	9.658620	10.341380	10.040963	9.959037	15	1
60	30	9.617727	10.382273	9.658704	10.341296	10.040977	9.959023	30	0
sec.		cosine.	secant.	cotangent.	tangent.	cosecant.	sine.		sec.
4 ^h 22 ^m		LOG. SINES, &c.						65 deg.	

1 ^h 38 ^m .		LOG. SINES, &c. (t.)					24 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.617727	10.382273	9.658704	10.341296	10.040977	9.959023	30	60
1	15	9.617796	10.382204	9.658788	10.341212	10.040992	9.959008	45	59
2	30	9.617865	10.382135	9.658871	10.341129	10.041006	9.958994	30	58
3	45	9.617935	10.382065	9.658955	10.341045	10.041020	9.958980	15	57
4	31	9.618004	10.381996	9.659039	10.340961	10.041035	9.958965	29	56
5	15	9.618073	10.381927	9.659122	10.340878	10.041049	9.958951	45	55
6	30	9.618142	10.381858	9.659206	10.340794	10.041064	9.958936	30	54
7	45	9.618212	10.381788	9.659290	10.340710	10.041078	9.958922	15	53
8	32	9.618281	10.381719	9.659373	10.340627	10.041092	9.958908	28	52
9	15	9.618350	10.381650	9.659457	10.340543	10.041107	9.958893	45	51
10	30	9.618419	10.381581	9.659540	10.340460	10.041121	9.958879	30	50
11	45	9.618488	10.381512	9.659624	10.340376	10.041136	9.958864	15	49
12	33	9.618558	10.381442	9.659708	10.340292	10.041150	9.958850	27	48
13	15	9.618627	10.381373	9.659791	10.340209	10.041164	9.958836	45	47
14	30	9.618696	10.381304	9.659875	10.340125	10.041179	9.958821	30	46
15	45	9.618765	10.381235	9.659958	10.340042	10.041193	9.958807	15	45
16	34	9.618834	10.381166	9.660042	10.339958	10.041208	9.958792	26	44
17	15	9.618903	10.381097	9.660125	10.339875	10.041222	9.958778	45	43
18	30	9.618972	10.381028	9.660209	10.339791	10.041237	9.958763	30	42
19	45	9.619041	10.380959	9.660292	10.339708	10.041251	9.958749	15	41
20	35	9.619110	10.380890	9.660376	10.339624	10.041266	9.958734	25	40
21	15	9.619179	10.380821	9.660459	10.339541	10.041280	9.958720	45	39
22	30	9.619248	10.380752	9.660543	10.339457	10.041294	9.958706	30	38
23	45	9.619317	10.380683	9.660626	10.339374	10.041309	9.958691	15	37
24	36	9.619386	10.380614	9.660710	10.339290	10.041323	9.958677	24	36
25	15	9.619455	10.380545	9.660793	10.339207	10.041338	9.958662	45	35
26	30	9.619524	10.380476	9.660877	10.339123	10.041352	9.958648	30	34
27	45	9.619593	10.380407	9.660960	10.339040	10.041367	9.958633	15	33
28	37	9.619662	10.380338	9.661043	10.338957	10.041381	9.958619	23	32
29	15	9.619731	10.380269	9.661127	10.338873	10.041396	9.958604	45	31
30	30	9.619800	10.380200	9.661210	10.338790	10.041410	9.958590	30	30
31	45	9.619869	10.380131	9.661293	10.338707	10.041425	9.958575	15	29
32	38	9.619938	10.380062	9.661377	10.338623	10.041439	9.958561	22	28
33	15	9.620007	10.379993	9.661460	10.338540	10.041454	9.958546	45	27
34	30	9.620075	10.379925	9.661544	10.338456	10.041468	9.958532	30	26
35	45	9.620144	10.379856	9.661627	10.338373	10.041483	9.958517	15	25
36	39	9.620213	10.379787	9.661710	10.338290	10.041497	9.958503	21	24
37	15	9.620282	10.379718	9.661794	10.338206	10.041512	9.958488	45	23
38	30	9.620351	10.379649	9.661877	10.338123	10.041526	9.958474	30	22
39	45	9.620420	10.379580	9.661960	10.338040	10.041541	9.958459	15	21
40	40	9.620488	10.379512	9.662043	10.337957	10.041555	9.958445	20	20
41	15	9.620557	10.379443	9.662127	10.337873	10.041570	9.958430	45	19
42	30	9.620626	10.379374	9.662210	10.337790	10.041584	9.958416	30	18
43	45	9.620695	10.379305	9.662293	10.337707	10.041599	9.958401	15	17
44	41	9.620763	10.379237	9.662376	10.337624	10.041613	9.958387	19	16
45	15	9.620832	10.379168	9.662460	10.337540	10.041628	9.958372	45	15
46	30	9.620901	10.379099	9.662543	10.337457	10.041642	9.958358	30	14
47	45	9.620969	10.379031	9.662626	10.337374	10.041657	9.958343	15	13
48	42	9.621038	10.378962	9.662709	10.337291	10.041671	9.958329	18	12
49	15	9.621107	10.378893	9.662792	10.337208	10.041686	9.958314	45	11
50	30	9.621175	10.378825	9.662876	10.337124	10.041700	9.958300	30	10
51	45	9.621244	10.378756	9.662959	10.337041	10.041715	9.958285	15	9
52	43	9.621313	10.378687	9.663042	10.336958	10.041729	9.958271	17	8
53	15	9.621381	10.378619	9.663125	10.336875	10.041744	9.958256	45	7
54	30	9.621450	10.378550	9.663208	10.336792	10.041758	9.958242	30	6
55	45	9.621518	10.378482	9.663291	10.336709	10.041773	9.958227	15	5
56	44	9.621587	10.378413	9.663374	10.336626	10.041788	9.958212	16	4
57	15	9.621656	10.378344	9.663458	10.336542	10.041802	9.958198	45	3
58	30	9.621724	10.378276	9.663541	10.336459	10.041817	9.958183	30	2
59	45	9.621793	10.378207	9.663624	10.336376	10.041831	9.958169	15	1
60	45	9.621861	10.378139	9.663707	10.336293	10.041846	9.958154	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 21 ^m .		LOG. SINES, &c.					65 deg.		

1 ^h 39 ^m .			LOG. SINES, &c. (t.)				24 deg		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.621861	10.378139	9.663707	10.336293	10.041846	9.958154	15	60
1	15	9.621930	10.378070	9.663790	10.336210	10.041860	9.958140	45	59
2	30	9.621998	10.378002	9.663873	10.336127	10.041875	9.958125	30	58
3	45	9.622067	10.377933	9.663956	10.336044	10.041889	9.958111	15	57
4	46	9.622135	10.377865	9.664039	10.335961	10.041904	9.958096	14	56
5	15	9.622204	10.377796	9.664122	10.335878	10.041919	9.958081	45	55
6	30	9.622272	10.377728	9.664205	10.335795	10.041933	9.958067	30	54
7	45	9.622340	10.377660	9.664288	10.335712	10.041948	9.958052	15	53
8	47	9.622409	10.377591	9.664371	10.335629	10.041962	9.958038	13	52
9	15	9.622477	10.377523	9.664454	10.335546	10.041977	9.958023	45	51
10	30	9.622546	10.377454	9.664537	10.335463	10.041991	9.958009	30	50
11	45	9.622614	10.377386	9.664620	10.335380	10.042006	9.957994	15	49
12	48	9.622682	10.377318	9.664703	10.335297	10.042021	9.957979	12	48
13	15	9.622751	10.377249	9.664786	10.335214	10.042035	9.957965	45	47
14	30	9.622819	10.377181	9.664869	10.335131	10.042050	9.957950	30	46
15	45	9.622887	10.377113	9.664952	10.335048	10.042064	9.957936	15	45
16	49	9.622956	10.377044	9.665035	10.334965	10.042079	9.957921	11	44
17	15	9.623024	10.376976	9.665117	10.334883	10.042094	9.957906	45	43
18	30	9.623092	10.376908	9.665200	10.334800	10.042108	9.957892	30	42
19	45	9.623160	10.376840	9.665283	10.334717	10.042123	9.957877	15	41
20	50	9.623229	10.376771	9.665366	10.334634	10.042137	9.957863	10	40
21	15	9.623297	10.376703	9.665449	10.334551	10.042152	9.957848	45	39
22	30	9.623365	10.376635	9.665532	10.334468	10.042167	9.957833	30	38
23	45	9.623433	10.376567	9.665615	10.334385	10.042181	9.957819	15	37
24	51	9.623502	10.376498	9.665697	10.334303	10.042196	9.957804	9	36
25	15	9.623570	10.376430	9.665780	10.334220	10.042211	9.957789	45	35
26	30	9.623638	10.376362	9.665863	10.334137	10.042225	9.957775	30	34
27	45	9.623706	10.376294	9.665946	10.334054	10.042240	9.957760	15	33
28	52	9.623774	10.376226	9.666029	10.333971	10.042254	9.957746	8	32
29	15	9.623842	10.376158	9.666111	10.333889	10.042269	9.957731	45	31
30	30	9.623911	10.376089	9.666194	10.333806	10.042284	9.957716	30	30
31	45	9.623979	10.376021	9.666277	10.333723	10.042298	9.957702	15	29
32	53	9.624047	10.375953	9.666360	10.333640	10.042313	9.957687	7	28
33	15	9.624115	10.375885	9.666442	10.333558	10.042328	9.957672	45	27
34	30	9.624183	10.375817	9.666525	10.333475	10.042342	9.957658	30	26
35	45	9.624251	10.375749	9.666608	10.333392	10.042357	9.957643	15	25
36	54	9.624319	10.375681	9.666691	10.333309	10.042372	9.957628	6	24
37	15	9.624387	10.375613	9.666773	10.333227	10.042386	9.957614	45	23
38	30	9.624455	10.375545	9.666856	10.333144	10.042401	9.957599	30	22
39	45	9.624523	10.375477	9.666939	10.333061	10.042416	9.957584	15	21
40	55	9.624591	10.375409	9.667021	10.332979	10.042430	9.957570	5	20
41	15	9.624659	10.375341	9.667104	10.332896	10.042445	9.957555	45	19
42	30	9.624727	10.375273	9.667187	10.332813	10.042460	9.957540	30	18
43	45	9.624795	10.375205	9.667269	10.332731	10.042474	9.957526	15	17
44	56	9.624863	10.375137	9.667352	10.332648	10.042489	9.957511	4	16
45	15	9.624931	10.375069	9.667435	10.332565	10.042504	9.957496	45	15
46	30	9.624999	10.375001	9.667517	10.332483	10.042518	9.957482	30	14
47	45	9.625067	10.374933	9.667600	10.332400	10.042533	9.957467	15	13
48	57	9.625135	10.374865	9.667682	10.332318	10.042548	9.957452	3	12
49	15	9.625202	10.374798	9.667765	10.332235	10.042563	9.957437	45	11
50	30	9.625270	10.374730	9.667847	10.332153	10.042577	9.957423	30	10
51	45	9.625338	10.374662	9.667930	10.332070	10.042592	9.957408	15	9
52	58	9.625406	10.374594	9.668013	10.331987	10.042607	9.957393	2	8
53	15	9.625474	10.374526	9.668095	10.331905	10.042621	9.957379	45	7
54	30	9.625542	10.374458	9.668178	10.331822	10.042636	9.957364	30	6
55	45	9.625609	10.374391	9.668260	10.331740	10.042651	9.957349	15	5
56	59	9.625677	10.374323	9.668343	10.331657	10.042665	9.957335	1	4
57	15	9.625745	10.374255	9.668425	10.331575	10.042680	9.957320	45	3
58	30	9.625813	10.374187	9.668508	10.331492	10.042695	9.957305	30	2
59	45	9.625880	10.374120	9.668590	10.331410	10.042710	9.957290	15	1
60	60	9.625948	10.374052	9.668672	10.331328	10.042724	9.957276	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.

4^h 20^m.

LOG. SINES, &c.

65 deg.

1 ^h 40 ^m .		LOG. SINES, &c. (1.)						25 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.	
0	0	9.625948	10.374052	9.668672	10.331328	10.042724	9.957276	60		60	
1	15	9.626016	10.373984	9.668755	10.331245	10.042739	9.957261	45		59	
2	30	9.626084	10.373916	9.668837	10.331163	10.042754	9.957246	30		58	
3	45	9.626151	10.373849	9.668920	10.331080	10.042769	9.957231	15		57	
4	1	9.626219	10.373781	9.669002	10.330998	10.042783	9.957217	59		56	
5	15	9.626287	10.373713	9.669085	10.330915	10.042798	9.957202	45		55	
6	30	9.626354	10.373646	9.669167	10.330833	10.042813	9.957187	30		54	
7	45	9.626422	10.373578	9.669249	10.330751	10.042827	9.957173	15		53	
8	2	9.626490	10.373510	9.669332	10.330668	10.042842	9.957158	58		52	
9	15	9.626557	10.373443	9.669414	10.330586	10.042857	9.957143	45		51	
10	30	9.626625	10.373375	9.669497	10.330503	10.042872	9.957128	30		50	
11	45	9.626692	10.373308	9.669579	10.330421	10.042887	9.957113	15		49	
12	3	9.626760	10.373240	9.669661	10.330339	10.042901	9.957099	57		48	
13	15	9.626828	10.373172	9.669744	10.330256	10.042916	9.957084	45		47	
14	30	9.626895	10.373105	9.669826	10.330174	10.042931	9.957069	30		46	
15	45	9.626963	10.373037	9.669908	10.330092	10.042946	9.957054	15		45	
16	4	9.627030	10.372970	9.669991	10.330009	10.042960	9.957040	56		44	
17	15	9.627098	10.372902	9.670073	10.329927	10.042975	9.957025	45		43	
18	30	9.627165	10.372835	9.670155	10.329845	10.042990	9.957010	30		42	
19	45	9.627233	10.372767	9.670237	10.329763	10.043005	9.956995	15		41	
20	5	9.627300	10.372700	9.670320	10.329680	10.043019	9.956981	55		40	
21	15	9.627368	10.372632	9.670402	10.329598	10.043034	9.956966	45		39	
22	30	9.627435	10.372565	9.670484	10.329516	10.043049	9.956951	30		38	
23	45	9.627503	10.372497	9.670566	10.329434	10.043064	9.956936	15		37	
24	6	9.627570	10.372430	9.670649	10.329351	10.043079	9.956921	54		36	
25	15	9.627637	10.372363	9.670731	10.329269	10.043093	9.956907	45		35	
26	30	9.627705	10.372295	9.670813	10.329187	10.043108	9.956892	30		34	
27	45	9.627772	10.372228	9.670895	10.329105	10.043123	9.956877	15		33	
28	7	9.627840	10.372160	9.670977	10.329023	10.043138	9.956862	53		32	
29	15	9.627907	10.372093	9.671060	10.328940	10.043153	9.956847	45		31	
30	30	9.627974	10.372026	9.671142	10.328858	10.043167	9.956833	30		30	
31	45	9.628042	10.371958	9.671224	10.328776	10.043182	9.956818	15		29	
32	8	9.628109	10.371891	9.671306	10.328694	10.043197	9.956803	52		28	
33	15	9.628176	10.371824	9.671388	10.328612	10.043212	9.956788	45		27	
34	30	9.628244	10.371756	9.671470	10.328530	10.043227	9.956773	30		26	
35	45	9.628311	10.371689	9.671552	10.328448	10.043242	9.956758	15		25	
36	9	9.628378	10.371622	9.671634	10.328366	10.043256	9.956744	51		24	
37	15	9.628445	10.371555	9.671717	10.328283	10.043271	9.956729	45		23	
38	30	9.628513	10.371487	9.671799	10.328201	10.043286	9.956714	30		22	
39	45	9.628580	10.371420	9.671881	10.328119	10.043301	9.956699	15		21	
40	10	9.628647	10.371353	9.671963	10.328037	10.043316	9.956684	50		20	
41	15	9.628714	10.371286	9.672045	10.327955	10.043331	9.956669	45		19	
42	30	9.628782	10.371218	9.672127	10.327873	10.043345	9.956655	30		18	
43	45	9.628849	10.371151	9.672209	10.327791	10.043360	9.956640	15		17	
44	11	9.628916	10.371084	9.672291	10.327709	10.043375	9.956625	49		16	
45	15	9.628983	10.371017	9.672373	10.327627	10.043390	9.956610	45		15	
46	30	9.629050	10.370950	9.672455	10.327545	10.043405	9.956595	30		14	
47	45	9.629117	10.370883	9.672537	10.327463	10.043420	9.956580	15		13	
48	12	9.629184	10.370816	9.672619	10.327381	10.043434	9.956566	48		12	
49	15	9.629252	10.370748	9.672701	10.327299	10.043449	9.956551	45		11	
50	30	9.629319	10.370681	9.672783	10.327217	10.043464	9.956536	30		10	
51	45	9.629386	10.370614	9.672865	10.327135	10.043479	9.956521	15		9	
52	13	9.629453	10.370547	9.672947	10.327053	10.043494	9.956506	47		8	
53	15	9.629520	10.370480	9.673029	10.326971	10.043509	9.956491	45		7	
54	30	9.629587	10.370413	9.673111	10.326889	10.043524	9.956476	30		6	
55	45	9.629654	10.370346	9.673193	10.326807	10.043539	9.956461	15		5	
56	14	9.629721	10.370279	9.673274	10.326726	10.043553	9.956447	46		4	
57	15	9.629788	10.370212	9.673356	10.326644	10.043568	9.956432	45		3	
58	30	9.629855	10.370145	9.673438	10.326562	10.043583	9.956417	30		2	
59	45	9.629922	10.370078	9.673520	10.326480	10.043598	9.956402	15		1	
60	15	9.629989	10.370011	9.673602	10.326398	10.043613	9.956387	45		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.	
4 ^h 19 ^m .		LOG. SINES, &c.						64 deg.			

1 ^h 41 ^m .		LOG. SINES, &c. (t.)						25 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.629989	10.370011	9.673002	10.326398	10.043613	9.956387	45	60
1	15	9.630056	10.369944	9.673684	10.326316	10.043628	9.956372	45	59
2	30	9.630123	10.369877	9.673766	10.326234	10.043643	9.956357	30	58
3	45	9.630190	10.369810	9.673847	10.326153	10.043658	9.956342	15	57
4	16	9.630257	10.369743	9.673929	10.326071	10.043673	9.956327	44	56
5	15	9.630324	10.369676	9.674011	10.325989	10.043688	9.956312	45	55
6	30	9.630391	10.369609	9.674093	10.325907	10.043702	9.956298	30	54
7	45	9.630457	10.369543	9.674175	10.325825	10.043717	9.956283	15	53
8	17	9.630524	10.369476	9.674257	10.325743	10.043732	9.956268	43	52
9	15	9.630591	10.369409	9.674338	10.325662	10.043747	9.956253	45	51
10	30	9.630658	10.369342	9.674420	10.325580	10.043762	9.956238	30	50
11	45	9.630725	10.369275	9.674502	10.325498	10.043777	9.956223	15	49
12	18	9.630792	10.369208	9.674584	10.325416	10.043792	9.956208	42	48
13	15	9.630858	10.369142	9.674665	10.325335	10.043807	9.956193	45	47
14	30	9.630925	10.369075	9.674747	10.325253	10.043822	9.956178	30	46
15	45	9.630992	10.369008	9.674829	10.325171	10.043837	9.956163	15	45
16	19	9.631059	10.368941	9.674910	10.325090	10.043852	9.956148	41	44
17	15	9.631126	10.368874	9.674992	10.325008	10.043867	9.956133	45	43
18	30	9.631192	10.368808	9.675074	10.324926	10.043882	9.956118	30	42
19	45	9.631259	10.368741	9.675156	10.324844	10.043897	9.956103	15	41
20	20	9.631326	10.368674	9.675237	10.324763	10.043911	9.956089	40	40
21	15	9.631392	10.368608	9.675319	10.324681	10.043926	9.956074	45	39
22	30	9.631459	10.368541	9.675401	10.324599	10.043941	9.956059	30	38
23	45	9.631526	10.368474	9.675482	10.324518	10.043956	9.956044	15	37
24	21	9.631593	10.368407	9.675564	10.324436	10.043971	9.956029	39	36
25	15	9.631659	10.368341	9.675645	10.324355	10.043986	9.956014	45	35
26	30	9.631726	10.368274	9.675727	10.324273	10.044001	9.955999	30	34
27	45	9.631792	10.368208	9.675809	10.324191	10.044016	9.955984	15	33
28	22	9.631859	10.368141	9.675890	10.324110	10.044031	9.955969	38	32
29	15	9.631926	10.368074	9.675972	10.324028	10.044046	9.955954	45	31
30	30	9.631992	10.368008	9.676053	10.323947	10.044061	9.955939	30	30
31	45	9.632059	10.367941	9.676135	10.323865	10.044076	9.955924	15	29
32	23	9.632125	10.367875	9.676216	10.323784	10.044091	9.955909	37	28
33	15	9.632192	10.367808	9.676298	10.323702	10.044106	9.955894	45	27
34	30	9.632259	10.367741	9.676380	10.323620	10.044121	9.955879	30	26
35	45	9.632325	10.367675	9.676461	10.323539	10.044136	9.955864	15	25
36	24	9.632392	10.367608	9.676543	10.323457	10.044151	9.955849	36	24
37	15	9.632458	10.367542	9.676624	10.323376	10.044166	9.955834	45	23
38	30	9.632525	10.367475	9.676706	10.323294	10.044181	9.955819	30	22
39	45	9.632591	10.367409	9.676787	10.323213	10.044196	9.955804	15	21
40	25	9.632658	10.367342	9.676869	10.323131	10.044211	9.955789	35	20
41	15	9.632724	10.367276	9.676950	10.323050	10.044226	9.955774	45	19
42	30	9.632790	10.367210	9.677031	10.322969	10.044241	9.955759	30	18
43	45	9.632857	10.367143	9.677113	10.322887	10.044256	9.955744	15	17
44	26	9.632923	10.367077	9.677194	10.322806	10.044271	9.955729	34	16
45	15	9.632990	10.367010	9.677276	10.322724	10.044286	9.955714	45	15
46	30	9.633056	10.366944	9.677357	10.322643	10.044301	9.955699	30	14
47	45	9.633122	10.366878	9.677439	10.322561	10.044316	9.955684	15	13
48	27	9.633189	10.366811	9.677520	10.322480	10.044331	9.955669	33	12
49	15	9.633255	10.366745	9.677601	10.322399	10.044346	9.955654	45	11
50	30	9.633322	10.366678	9.677683	10.322317	10.044361	9.955639	30	10
51	45	9.633388	10.366612	9.677764	10.322236	10.044376	9.955624	15	9
52	28	9.633454	10.366546	9.677846	10.322154	10.044391	9.955609	32	8
53	15	9.633520	10.366480	9.677927	10.322073	10.044406	9.955594	45	7
54	30	9.633587	10.366413	9.678008	10.321992	10.044421	9.955579	30	6
55	45	9.633653	10.366347	9.678090	10.321910	10.044437	9.955563	15	5
56	29	9.633719	10.366281	9.678171	10.321829	10.044452	9.955548	31	4
57	15	9.633786	10.366214	9.678252	10.321748	10.044467	9.955533	45	3
58	30	9.633852	10.366148	9.678333	10.321667	10.044482	9.955518	30	2
59	45	9.633918	10.366082	9.678415	10.321585	10.044497	9.955503	15	1
60	30	9.633984	10.366016	9.678496	10.321504	10.044512	9.955488	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
4 ^h 18 ^m .		LOG. SINES, &c.						64 deg.	

1 ^h 42 ^m .		LOG. SINES, &c. (t.)						25 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.633984	10.3636016	9.678496	10.321504	10.044512	9.955488	30	60
1	15	9.634051	10.365949	9.678577	10.321423	10.044527	9.955473	45	59
2	30	9.634117	10.365833	9.678659	10.321341	10.044542	9.955458	30	58
3	45	9.634183	10.365817	9.678740	10.321260	10.044557	9.955443	15	57
4	31	9.634249	10.365751	9.678821	10.321179	10.044572	9.955428	29	56
5	15	9.634315	10.365685	9.678902	10.321098	10.044587	9.955413	45	55
6	30	9.634381	10.365619	9.678984	10.321016	10.044602	9.955398	30	54
7	45	9.634447	10.365553	9.679065	10.320935	10.044617	9.955383	15	53
8	32	9.634514	10.365486	9.679146	10.320854	10.044632	9.955368	28	52
9	15	9.634580	10.365420	9.679227	10.320773	10.044647	9.955353	45	51
10	30	9.634646	10.365354	9.679308	10.320692	10.044663	9.955337	30	50
11	45	9.634712	10.365288	9.679390	10.320610	10.044678	9.955322	15	49
12	33	9.634778	10.365222	9.679471	10.320529	10.044693	9.955307	27	48
13	15	9.634844	10.365156	9.679552	10.320448	10.044708	9.955292	45	47
14	30	9.634910	10.365090	9.679633	10.320367	10.044723	9.955277	30	46
15	45	9.634976	10.365024	9.679714	10.320286	10.044738	9.955262	15	45
16	34	9.635042	10.364958	9.679795	10.320205	10.044753	9.955247	26	44
17	15	9.635108	10.364892	9.679876	10.320124	10.044768	9.955232	45	43
18	30	9.635174	10.364826	9.679958	10.320042	10.044783	9.955217	30	42
19	45	9.635240	10.364760	9.680039	10.319961	10.044799	9.955201	15	41
20	35	9.635306	10.364694	9.680120	10.319880	10.044814	9.955186	25	40
21	15	9.635372	10.364628	9.680201	10.319799	10.044829	9.955171	45	39
22	30	9.635438	10.364562	9.680282	10.319718	10.044844	9.955156	30	38
23	45	9.635504	10.364496	9.680363	10.319637	10.044859	9.955141	15	37
24	36	9.635570	10.364430	9.680444	10.319556	10.044874	9.955126	24	36
25	15	9.635636	10.364364	9.680525	10.319475	10.044889	9.955111	45	35
26	30	9.635702	10.364298	9.680606	10.319394	10.044904	9.955096	30	34
27	45	9.635768	10.364232	9.680687	10.319313	10.044920	9.955080	15	33
28	37	9.635833	10.364167	9.680768	10.319232	10.044935	9.955065	23	32
29	15	9.635899	10.364101	9.680849	10.319151	10.044950	9.955050	45	31
30	30	9.635965	10.364035	9.680930	10.319070	10.044965	9.955035	30	30
31	45	9.636031	10.363969	9.681011	10.318989	10.044980	9.955020	15	29
32	38	9.636097	10.363903	9.681092	10.318908	10.044995	9.955005	22	28
33	15	9.636163	10.363837	9.681173	10.318827	10.045010	9.954990	45	27
34	30	9.636228	10.363772	9.681254	10.318746	10.045026	9.954974	30	26
35	45	9.636294	10.363706	9.681335	10.318665	10.045041	9.954959	15	25
36	39	9.636360	10.363640	9.681416	10.318584	10.045056	9.954944	21	24
37	15	9.636426	10.363574	9.681497	10.318503	10.045071	9.954929	45	23
38	30	9.636492	10.363508	9.681578	10.318422	10.045086	9.954914	30	22
39	45	9.636557	10.363443	9.681659	10.318341	10.045101	9.954899	15	21
40	40	9.636623	10.363377	9.681740	10.318260	10.045117	9.954883	20	20
41	15	9.636689	10.363311	9.681820	10.318180	10.045132	9.954868	45	19
42	30	9.636754	10.363246	9.681901	10.318099	10.045147	9.954853	30	18
43	45	9.636820	10.363180	9.681982	10.318018	10.045162	9.954838	15	17
44	41	9.636886	10.363114	9.682063	10.317937	10.045177	9.954823	19	16
45	15	9.636951	10.363049	9.682144	10.317856	10.045193	9.954807	45	15
46	30	9.637017	10.362983	9.682225	10.317775	10.045208	9.954792	30	14
47	45	9.637083	10.362917	9.682306	10.317694	10.045223	9.954777	15	13
48	42	9.637148	10.362852	9.682386	10.317614	10.045238	9.954762	18	12
49	15	9.637214	10.362786	9.682467	10.317533	10.045253	9.954747	45	11
50	30	9.637280	10.362720	9.682548	10.317452	10.045269	9.954731	30	10
51	45	9.637345	10.362655	9.682629	10.317371	10.045284	9.954716	15	9
52	43	9.637411	10.362589	9.682710	10.317290	10.045299	9.954701	17	8
53	15	9.637476	10.362524	9.682790	10.317210	10.045314	9.954686	45	7
54	30	9.637542	10.362458	9.682871	10.317129	10.045329	9.954671	30	6
55	45	9.637607	10.362393	9.682952	10.317048	10.045345	9.954655	15	5
56	44	9.637673	10.362327	9.683033	10.316967	10.045360	9.954640	16	4
57	15	9.637739	10.362261	9.683114	10.316886	10.045375	9.954625	45	3
58	30	9.637804	10.362196	9.683194	10.316806	10.045390	9.954610	30	2
59	45	9.637870	10.362130	9.683275	10.316725	10.045406	9.954594	15	1
60	45	9.637935	10.362065	9.683356	10.316644	10.045421	9.954579	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 17 ^m .		LOG. SINES, &c.						64 deg.	

1 ^h 43 ^m .				LOG. SINES, &c. (t.)				25 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.		
0	45	9.637935	10.362065	9.683356	10.316644	10.045421	9.954579	15	60		
1	15	9.638000	10.362000	9.683436	10.316564	10.045436	9.954564	45	59		
2	30	9.638066	10.361934	9.683517	10.316483	10.045451	9.954549	30	58		
3	45	9.638131	10.361869	9.683598	10.316402	10.045466	9.954534	15	57		
4	46	9.638197	10.361803	9.683678	10.316322	10.045482	9.954518	14	56		
5	15	9.638262	10.361738	9.683759	10.316241	10.045497	9.954503	45	55		
6	30	9.638328	10.361672	9.683840	10.316160	10.045512	9.954488	30	54		
7	45	9.638393	10.361607	9.683920	10.316080	10.045527	9.954473	15	53		
8	47	9.638458	10.361542	9.684001	10.315999	10.045543	9.954457	13	52		
9	15	9.638524	10.361476	9.684082	10.315918	10.045558	9.954442	45	51		
10	30	9.638589	10.361411	9.684162	10.315838	10.045573	9.954427	30	50		
11	45	9.638655	10.361345	9.684243	10.315757	10.045588	9.954412	15	49		
12	48	9.638720	10.361280	9.684324	10.315676	10.045604	9.954396	12	48		
13	15	9.638785	10.361215	9.684404	10.315596	10.045619	9.954381	45	47		
14	30	9.638851	10.361149	9.684485	10.315515	10.045634	9.954366	30	46		
15	45	9.638916	10.361084	9.684565	10.315435	10.045650	9.954350	15	45		
16	49	9.638981	10.361019	9.684646	10.315354	10.045665	9.954335	11	44		
17	15	9.639046	10.360954	9.684726	10.315274	10.045680	9.954320	45	43		
18	30	9.639112	10.360888	9.684807	10.315193	10.045695	9.954305	30	42		
19	45	9.639177	10.360823	9.684888	10.315112	10.045711	9.954289	15	41		
20	50	9.639242	10.360758	9.684968	10.315032	10.045726	9.954274	10	40		
21	15	9.639307	10.360693	9.685049	10.314951	10.045741	9.954259	45	39		
22	30	9.639373	10.360627	9.685129	10.314871	10.045757	9.954243	30	38		
23	45	9.639438	10.360562	9.685210	10.314790	10.045772	9.954228	15	37		
24	51	9.639503	10.360497	9.685290	10.314710	10.045787	9.954213	9	36		
25	15	9.639568	10.360432	9.685371	10.314629	10.045802	9.954198	45	35		
26	30	9.639633	10.360367	9.685451	10.314549	10.045818	9.954182	30	34		
27	45	9.639698	10.360302	9.685532	10.314468	10.045833	9.954167	15	33		
28	52	9.639764	10.360236	9.685612	10.314388	10.045848	9.954152	8	32		
29	15	9.639829	10.360171	9.685692	10.314308	10.045864	9.954136	45	31		
30	30	9.639894	10.360106	9.685773	10.314227	10.045879	9.954121	30	30		
31	45	9.639959	10.360041	9.685853	10.314147	10.045894	9.954106	15	29		
32	53	9.640024	10.359976	9.685934	10.314066	10.045910	9.954090	7	28		
33	15	9.640089	10.359911	9.686014	10.313986	10.045925	9.954075	45	27		
34	30	9.640154	10.359846	9.686095	10.313905	10.045940	9.954060	30	26		
35	45	9.640219	10.359781	9.686175	10.313825	10.045956	9.954044	15	25		
36	54	9.640284	10.359716	9.686255	10.313745	10.045971	9.954029	6	24		
37	15	9.640349	10.359651	9.686336	10.313664	10.045986	9.954014	45	23		
38	30	9.640414	10.359586	9.686416	10.313584	10.046002	9.953998	30	22		
39	45	9.640479	10.359521	9.686496	10.313504	10.046017	9.953983	15	21		
40	55	9.640544	10.359456	9.686577	10.313423	10.046032	9.953968	5	20		
41	15	9.640609	10.359391	9.686657	10.313343	10.046048	9.953952	45	19		
42	30	9.640674	10.359326	9.686737	10.313263	10.046063	9.953937	30	18		
43	45	9.640739	10.359261	9.686818	10.313182	10.046078	9.953922	15	17		
44	56	9.640804	10.359196	9.686898	10.313102	10.046094	9.953906	4	16		
45	15	9.640869	10.359131	9.686978	10.313022	10.046109	9.953891	45	15		
46	30	9.640934	10.359066	9.687059	10.312941	10.046124	9.953876	30	14		
47	45	9.640999	10.359001	9.687139	10.312861	10.046140	9.953860	15	13		
48	57	9.641064	10.358936	9.687219	10.312781	10.046155	9.953845	3	12		
49	15	9.641129	10.358871	9.687299	10.312701	10.046171	9.953829	45	11		
50	30	9.641194	10.358806	9.687380	10.312620	10.046186	9.953814	30	10		
51	45	9.641259	10.358741	9.687460	10.312540	10.046201	9.953799	15	9		
52	58	9.641323	10.358677	9.687540	10.312460	10.046217	9.953783	2	8		
53	15	9.641388	10.358612	9.687620	10.312380	10.046232	9.953768	45	7		
54	30	9.641453	10.358547	9.687701	10.312299	10.046247	9.953753	30	6		
55	45	9.641518	10.358482	9.687781	10.312219	10.046263	9.953737	15	5		
56	59	9.641583	10.358417	9.687861	10.312139	10.046278	9.953722	1	4		
57	15	9.641648	10.358352	9.687941	10.312059	10.046294	9.953706	45	3		
58	30	9.641712	10.358288	9.688021	10.311979	10.046309	9.953691	30	2		
59	45	9.641777	10.358223	9.688102	10.311898	10.046324	9.953676	15	1		
60	60	9.641842	10.358158	9.688182	10.311818	10.046340	9.953660	()	0		
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.		
4 ^h 16 ^m .				LOG. SINES, &c.				64 deg.			

1 ^h 44 ^m .			LOG. SINES, &c. (t.)					26 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	0	9.641842	10.358158	9.688182	10.311818	10.046340	9.953660	60		60
1	15	9.641907	10.358093	9.688262	10.311738	10.046355	9.953645	45		59
2	30	9.641971	10.358029	9.688342	10.311658	10.046371	9.953629	30		58
3	45	9.642036	10.357964	9.688422	10.311578	10.046386	9.953614	15		57
4	1	9.642101	10.357899	9.688502	10.311498	10.046402	9.953598	59		56
5	15	9.642166	10.357834	9.688582	10.311418	10.046417	9.953583	45		55
6	30	9.642230	10.357770	9.688663	10.311337	10.046432	9.953568	30		54
7	45	9.642295	10.357705	9.688743	10.311257	10.046448	9.953552	15		53
8	2	9.642360	10.357640	9.688823	10.311177	10.046463	9.953537	58		52
9	15	9.642424	10.357576	9.688903	10.311097	10.046479	9.953521	45		51
10	30	9.642489	10.357511	9.688983	10.311017	10.046494	9.953506	30		50
11	45	9.642553	10.357447	9.689063	10.310937	10.046509	9.953491	15		49
12	3	9.642618	10.357382	9.689143	10.310857	10.046525	9.953475	57		48
13	15	9.642683	10.357317	9.689223	10.310777	10.046540	9.953460	45		47
14	30	9.642747	10.357253	9.689303	10.310697	10.046556	9.953444	30		46
15	45	9.642812	10.357188	9.689383	10.310617	10.046571	9.953429	15		45
16	4	9.642876	10.357124	9.689463	10.310537	10.046587	9.953413	56		44
17	15	9.642941	10.357059	9.689543	10.310457	10.046602	9.953398	45		43
18	30	9.643006	10.356994	9.689623	10.310377	10.046618	9.953382	30		42
19	45	9.643070	10.356930	9.689703	10.310297	10.046633	9.953367	15		41
20	5	9.643135	10.356865	9.689783	10.310217	10.046649	9.953351	55		40
21	15	9.643199	10.356801	9.689863	10.310137	10.046664	9.953336	45		39
22	30	9.643264	10.356736	9.689943	10.310057	10.046679	9.953321	30		38
23	45	9.643328	10.356672	9.690023	10.309977	10.046695	9.953305	15		37
24	6	9.643393	10.356607	9.690103	10.309897	10.046710	9.953290	54		36
25	15	9.643457	10.356543	9.690183	10.309817	10.046726	9.953274	45		35
26	30	9.643521	10.356479	9.690263	10.309737	10.046741	9.953259	30		34
27	45	9.643586	10.356414	9.690343	10.309657	10.046757	9.953243	15		33
28	7	9.643650	10.356350	9.690423	10.309577	10.046772	9.953228	53		32
29	15	9.643715	10.356285	9.690502	10.309498	10.046788	9.953212	45		31
30	30	9.643779	10.356221	9.690582	10.309418	10.046803	9.953197	30		30
31	45	9.643844	10.356156	9.690662	10.309338	10.046819	9.953181	15		29
32	8	9.643908	10.356092	9.690742	10.309258	10.046834	9.953166	52		28
33	15	9.643972	10.356028	9.690822	10.309178	10.046850	9.953150	45		27
34	30	9.644037	10.355963	9.690902	10.309098	10.046865	9.953135	30		26
35	45	9.644101	10.355899	9.690982	10.309018	10.046881	9.953119	15		25
36	9	9.644165	10.355835	9.691062	10.308938	10.046896	9.953104	51		24
37	15	9.644230	10.355770	9.691141	10.308859	10.046912	9.953088	45		23
38	30	9.644294	10.355706	9.691221	10.308779	10.046927	9.953073	30		22
39	45	9.644358	10.355642	9.691301	10.308699	10.046943	9.953057	15		21
40	10	9.644423	10.355577	9.691381	10.308619	10.046958	9.953042	50		20
41	15	9.644487	10.355513	9.691461	10.308539	10.046974	9.953026	45		19
42	30	9.644551	10.355449	9.691540	10.308460	10.046989	9.953011	30		18
43	45	9.644615	10.355385	9.691620	10.308380	10.047005	9.952995	15		17
44	11	9.644680	10.355320	9.691700	10.308300	10.047020	9.952980	49		16
45	15	9.644744	10.355256	9.691780	10.308220	10.047036	9.952964	45		15
46	30	9.644808	10.355192	9.691859	10.308141	10.047051	9.952949	30		14
47	45	9.644872	10.355128	9.691939	10.308061	10.047067	9.952933	15		13
48	12	9.644936	10.355064	9.692019	10.307981	10.047083	9.952917	48		12
49	15	9.645001	10.354999	9.692099	10.307901	10.047098	9.952902	45		11
50	30	9.645065	10.354935	9.692178	10.307822	10.047114	9.952886	30		10
51	45	9.645129	10.354871	9.692258	10.307742	10.047129	9.952871	15		9
52	13	9.645193	10.354807	9.692338	10.307662	10.047145	9.952855	47		8
53	15	9.645257	10.354743	9.692417	10.307583	10.047160	9.952840	45		7
54	30	9.645321	10.354679	9.692497	10.307503	10.047176	9.952824	30		6
55	45	9.645385	10.354615	9.692577	10.307423	10.047191	9.952809	15		5
56	14	9.645450	10.354550	9.692656	10.307344	10.047207	9.952793	46		4
57	15	9.645514	10.354486	9.692736	10.307264	10.047223	9.952777	45		3
58	30	9.645578	10.354422	9.692816	10.307184	10.047238	9.952762	30		2
59	45	9.645642	10.354358	9.692895	10.307105	10.047254	9.952746	15		1
60	15	9.645706	10.354294	9.692975	10.307025	10.047269	9.952731	45		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
4 ^h 15 ^m .			LOG. SINES, &c.					63 deg.		

1 ^h 45 ^m .		LOG. SINES, &c. (t.)						26 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	15	9.645706	10.354294	9.692975	10.307025	10.047269	9.952731	45		60
1	15	9.645770	10.354230	9.693055	10.306945	10.047285	9.952715	45		59
2	30	9.645834	10.354166	9.693134	10.306866	10.047300	9.952700	30		58
3	45	9.645898	10.354102	9.693214	10.306786	10.047316	9.952684	15		57
4	16	9.645962	10.354038	9.693293	10.306707	10.047332	9.952668	44		56
5	15	9.646026	10.353974	9.693373	10.306627	10.047347	9.952653	45		55
6	30	9.646090	10.353910	9.693453	10.306547	10.047363	9.952637	30		54
7	45	9.646154	10.353846	9.693532	10.306468	10.047378	9.952622	15		53
8	17	9.646218	10.353782	9.693612	10.306388	10.047394	9.952606	43		52
9	15	9.646282	10.353718	9.693691	10.306309	10.047410	9.952590	45		51
10	30	9.646346	10.353654	9.693771	10.306229	10.047425	9.952575	30		50
11	45	9.646410	10.353590	9.693850	10.306150	10.047441	9.952559	15		49
12	18	9.646473	10.353527	9.693930	10.306070	10.047456	9.952544	42		48
13	15	9.646537	10.353463	9.694009	10.305991	10.047472	9.952528	45		47
14	30	9.646601	10.353399	9.694089	10.305911	10.047488	9.952512	30		46
15	45	9.646665	10.353335	9.694168	10.305832	10.047503	9.952497	15		45
16	19	9.646729	10.353271	9.694248	10.305752	10.047519	9.952481	41		44
17	15	9.646793	10.353207	9.694327	10.305673	10.047534	9.952466	45		43
18	30	9.646857	10.353143	9.694407	10.305593	10.047550	9.952450	30		42
19	45	9.646920	10.353080	9.694486	10.305514	10.047566	9.952434	15		41
20	20	9.646984	10.353016	9.694566	10.305434	10.047581	9.952419	40		40
21	15	9.647048	10.352952	9.694645	10.305355	10.047597	9.952403	45		39
22	30	9.647112	10.352888	9.694724	10.305276	10.047613	9.952387	30		38
23	45	9.647176	10.352824	9.694804	10.305196	10.047628	9.952372	15		37
24	21	9.647239	10.352761	9.694883	10.305117	10.047644	9.952356	39		36
25	15	9.647303	10.352697	9.694963	10.305037	10.047659	9.952341	45		35
26	30	9.647367	10.352633	9.695042	10.304958	10.047675	9.952325	30		34
27	45	9.647431	10.352569	9.695121	10.304879	10.047691	9.952309	15		33
28	22	9.647494	10.352506	9.695201	10.304799	10.047706	9.952294	38		32
29	15	9.647558	10.352442	9.695280	10.304720	10.047722	9.952278	45		31
30	30	9.647622	10.352378	9.695360	10.304640	10.047738	9.952262	30		30
31	45	9.647686	10.352314	9.695439	10.304561	10.047753	9.952247	15		29
32	23	9.647749	10.352251	9.695518	10.304482	10.047769	9.952231	37		28
33	15	9.647813	10.352187	9.695598	10.304402	10.047785	9.952215	45		27
34	30	9.647877	10.352123	9.695677	10.304323	10.047800	9.952200	30		26
35	45	9.647940	10.352060	9.695756	10.304244	10.047816	9.952184	15		25
36	24	9.648004	10.351996	9.695835	10.304165	10.047832	9.952168	36		24
37	15	9.648067	10.351933	9.695915	10.304085	10.047847	9.952153	45		23
38	30	9.648131	10.351869	9.695994	10.304006	10.047863	9.952137	30		22
39	45	9.648195	10.351805	9.696073	10.303927	10.047879	9.952121	15		21
40	25	9.648258	10.351742	9.696153	10.303847	10.047895	9.952105	35		20
41	15	9.648322	10.351678	9.696232	10.303768	10.047910	9.952090	45		19
42	30	9.648385	10.351615	9.696311	10.303688	10.047926	9.952074	30		18
43	45	9.648449	10.351551	9.696390	10.303610	10.047942	9.952058	15		17
44	26	9.648512	10.351488	9.696470	10.303530	10.047957	9.952043	34		16
45	15	9.648576	10.351424	9.696549	10.303451	10.047973	9.952027	45		15
46	30	9.648639	10.351361	9.696628	10.303372	10.047989	9.952011	30		14
47	45	9.648703	10.351297	9.696707	10.303293	10.048004	9.951996	15		13
48	27	9.648766	10.351234	9.696786	10.303214	10.048020	9.951980	33		12
49	15	9.648830	10.351170	9.696866	10.303134	10.048036	9.951964	45		11
50	30	9.648893	10.351107	9.696945	10.303055	10.048052	9.951948	30		10
51	45	9.648957	10.351043	9.697024	10.302976	10.048067	9.951933	15		9
52	28	9.649020	10.350980	9.697103	10.302897	10.048083	9.951917	32		8
53	15	9.649084	10.350916	9.697182	10.302818	10.048099	9.951901	45		7
54	30	9.649147	10.350853	9.697261	10.302739	10.048114	9.951886	30		6
55	45	9.649211	10.350789	9.697341	10.302659	10.048130	9.951870	15		5
56	29	9.649274	10.350726	9.697420	10.302580	10.048146	9.951854	31		4
57	15	9.649337	10.350663	9.697499	10.302501	10.048162	9.951838	45		3
58	30	9.649401	10.350599	9.697578	10.302422	10.048177	9.951823	30		2
59	45	9.649464	10.350536	9.697657	10.302343	10.048193	9.951807	15		1
60	30	9.649527	10.350473	9.697736	10.302264	10.048209	9.951791	30		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
4 ^h 14 ^m .		LOG. SINES, &c.						63 deg.		

1 ^h 46 ^m .			LOG. SINES, &c. (t.)						26 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	30	9.649527	10.350473	9.697736	10.302264	10.048209	9.951791	30		60	
1	15	9.649591	10.350409	9.697815	10.302185	10.048225	9.951775	45		59	
2	30	9.649654	10.350346	9.697894	10.302106	10.048240	9.951760	30		58	
3	45	9.649717	10.350283	9.697973	10.302027	10.048256	9.951744	15		57	
4	31	9.649781	10.350219	9.698053	10.301947	10.048272	9.951728	29		56	
5	15	9.649844	10.350156	9.698132	10.301868	10.048288	9.951712	45		55	
6	30	9.649907	10.350093	9.698211	10.301789	10.048303	9.951697	30		54	
7	45	9.649971	10.350029	9.698290	10.301710	10.048319	9.951681	15		53	
8	32	9.650034	10.349966	9.698369	10.301631	10.048335	9.951665	28		52	
9	15	9.650097	10.349903	9.698448	10.301552	10.048351	9.951649	45		51	
10	30	9.650160	10.349840	9.698527	10.301473	10.048366	9.951634	30		50	
11	45	9.650223	10.349777	9.698606	10.301394	10.048382	9.951618	15		49	
12	33	9.650287	10.349713	9.698685	10.301315	10.048398	9.951602	27		48	
13	15	9.650350	10.349650	9.698764	10.301236	10.048414	9.951586	45		47	
14	30	9.650413	10.349587	9.698843	10.301157	10.048430	9.951570	30		46	
15	45	9.650476	10.349524	9.698922	10.301078	10.048445	9.951555	15		45	
16	34	9.650539	10.349461	9.699001	10.300999	10.048461	9.951539	26		44	
17	15	9.650603	10.349397	9.699080	10.300920	10.048477	9.951523	45		43	
18	30	9.650666	10.349334	9.699158	10.300842	10.048493	9.951507	30		42	
19	45	9.650729	10.349271	9.699237	10.300763	10.048509	9.951491	15		41	
20	35	9.650792	10.349208	9.699316	10.300684	10.048524	9.951476	25		40	
21	15	9.650855	10.349145	9.699395	10.300605	10.048540	9.951460	45		39	
22	30	9.650918	10.349082	9.699474	10.300526	10.048556	9.951444	30		38	
23	45	9.650981	10.349019	9.699553	10.300447	10.048572	9.951428	15		37	
24	36	9.651044	10.348956	9.699632	10.300368	10.048588	9.951412	24		36	
25	15	9.651107	10.348893	9.699711	10.300289	10.048603	9.951397	45		35	
26	30	9.651170	10.348830	9.699790	10.300210	10.048619	9.951381	30		34	
27	45	9.651234	10.348766	9.699869	10.300131	10.048635	9.951365	15		33	
28	37	9.651297	10.348703	9.699947	10.300053	10.048651	9.951349	23		32	
29	15	9.651360	10.348640	9.700026	10.299974	10.048667	9.951333	45		31	
30	30	9.651423	10.348577	9.700105	10.299895	10.048683	9.951317	30		30	
31	45	9.651486	10.348514	9.700184	10.299816	10.048698	9.951302	15		29	
32	38	9.651549	10.348451	9.700263	10.299737	10.048714	9.951286	22		28	
33	15	9.651612	10.348388	9.700342	10.299658	10.048730	9.951270	45		27	
34	30	9.651674	10.348326	9.700420	10.299580	10.048746	9.951254	30		26	
35	45	9.651737	10.348263	9.700499	10.299501	10.048762	9.951238	15		25	
36	39	9.651800	10.348200	9.700578	10.299422	10.048778	9.951222	21		24	
37	15	9.651863	10.348137	9.700657	10.299343	10.048793	9.951207	45		23	
38	30	9.651926	10.348074	9.700735	10.299265	10.048809	9.951191	30		22	
39	45	9.651989	10.348011	9.700814	10.299186	10.048825	9.951175	15		21	
40	40	9.652052	10.347948	9.700893	10.299107	10.048841	9.951159	20		20	
41	15	9.652115	10.347885	9.700972	10.299028	10.048857	9.951143	45		19	
42	30	9.652178	10.347822	9.701050	10.298950	10.048873	9.951127	30		18	
43	45	9.652241	10.347759	9.701129	10.298871	10.048889	9.951111	15		17	
44	41	9.652303	10.347697	9.701208	10.298792	10.048904	9.951096	19		16	
45	15	9.652366	10.347634	9.701287	10.298713	10.048920	9.951080	45		15	
46	30	9.652429	10.347571	9.701365	10.298635	10.048936	9.951064	30		14	
47	45	9.652492	10.347508	9.701444	10.298556	10.048952	9.951048	15		13	
48	42	9.652555	10.347445	9.701523	10.298477	10.048968	9.951032	18		12	
49	15	9.652618	10.347382	9.701601	10.298399	10.048984	9.951016	45		11	
50	30	9.652680	10.347320	9.701680	10.298320	10.049000	9.951000	30		10	
51	45	9.652743	10.347257	9.701759	10.298241	10.049016	9.950984	15		9	
52	43	9.652806	10.347194	9.701837	10.298163	10.049032	9.950968	17		8	
53	15	9.652869	10.347131	9.701916	10.298084	10.049047	9.950953	45		7	
54	30	9.652931	10.347069	9.701995	10.298005	10.049063	9.950937	30		6	
55	45	9.652994	10.347006	9.702073	10.297927	10.049079	9.950921	15		5	
56	44	9.653057	10.346943	9.702152	10.297848	10.049095	9.950905	16		4	
57	15	9.653119	10.346881	9.702230	10.297770	10.049111	9.950889	45		3	
58	30	9.653182	10.346818	9.702309	10.297691	10.049127	9.950873	30		2	
59	45	9.653245	10.346755	9.702388	10.297612	10.049143	9.950857	15		1	
60	45	9.653307	10.346693	9.702466	10.297534	10.049159	9.950841	15		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
4 ^h 13 ^m .			LOG. SINES, &c.						63 deg.		

1 ⁿ 47 ^m .			LOG. SINES, &c. (t.)						26 deg		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	45	9.653307	10.346693	9.702466	10.297534	10.049159	9.950841	15		60	
1	15	9.653370	10.346630	9.702545	10.297455	10.049175	9.950825	45		59	
2	30	9.653433	10.346567	9.702623	10.297377	10.049191	9.950809	30		58	
3	45	9.653495	10.346505	9.702702	10.297298	10.049207	9.950793	15		57	
4	46	9.653558	10.346442	9.702780	10.297220	10.049223	9.950777	14		56	
5	15	9.653621	10.346379	9.702859	10.297141	10.049238	9.950762	45		55	
6	30	9.653683	10.346317	9.702938	10.297062	10.049254	9.950746	30		54	
7	45	9.653746	10.346254	9.703016	10.296984	10.049270	9.950730	15		53	
8	47	9.653808	10.346192	9.703095	10.296905	10.049286	9.950714	13		52	
9	15	9.653871	10.346129	9.703173	10.296827	10.049302	9.950698	45		51	
10	30	9.653933	10.346067	9.703252	10.296748	10.049318	9.950682	30		50	
11	45	9.653996	10.346004	9.703330	10.296670	10.049334	9.950666	15		49	
12	48	9.654059	10.345941	9.703409	10.296591	10.049350	9.950650	12		48	
13	15	9.654121	10.345879	9.703487	10.296513	10.049366	9.950634	45		47	
14	30	9.654184	10.345816	9.703566	10.296434	10.049382	9.950618	30		46	
15	45	9.654246	10.345754	9.703644	10.296356	10.049398	9.950602	15		45	
16	49	9.654309	10.345691	9.703722	10.296278	10.049414	9.950586	11		44	
17	15	9.654371	10.345629	9.703801	10.296199	10.049430	9.950570	45		43	
18	30	9.654433	10.345567	9.703879	10.296121	10.049446	9.950554	30		42	
19	45	9.654496	10.345504	9.703958	10.296042	10.049462	9.950538	15		41	
20	50	9.654558	10.345442	9.704036	10.295964	10.049478	9.950522	10		40	
21	15	9.654621	10.345379	9.704115	10.295885	10.049494	9.950506	45		39	
22	30	9.654683	10.345317	9.704193	10.295807	10.049510	9.950490	30		38	
23	45	9.654746	10.345254	9.704271	10.295729	10.049526	9.950474	15		37	
24	51	9.654808	10.345192	9.704350	10.295650	10.049542	9.950458	9		36	
25	15	9.654870	10.345130	9.704428	10.295572	10.049558	9.950442	45		35	
26	30	9.654933	10.345067	9.704506	10.295494	10.049574	9.950426	30		34	
27	45	9.654995	10.345005	9.704585	10.295415	10.049590	9.950410	15		33	
28	52	9.655057	10.344943	9.704663	10.295337	10.049606	9.950394	8		32	
29	15	9.655120	10.344880	9.704741	10.295259	10.049622	9.950378	45		31	
30	30	9.655182	10.344818	9.704820	10.295180	10.049638	9.950362	30		30	
31	45	9.655244	10.344756	9.704898	10.295102	10.049654	9.950346	15		29	
32	53	9.655307	10.344693	9.704976	10.295024	10.049670	9.950330	7		28	
33	15	9.655369	10.344631	9.705055	10.294945	10.049686	9.950314	45		27	
34	30	9.655431	10.344569	9.705133	10.294867	10.049702	9.950298	30		26	
35	45	9.655494	10.344506	9.705211	10.294789	10.049718	9.950282	15		25	
36	54	9.655556	10.344444	9.705290	10.294710	10.049734	9.950266	6		24	
37	15	9.655618	10.344382	9.705368	10.294632	10.049750	9.950250	45		23	
38	30	9.655680	10.344320	9.705446	10.294554	10.049766	9.950234	30		22	
39	45	9.655743	10.344257	9.705524	10.294476	10.049782	9.950218	15		21	
40	55	9.655805	10.344195	9.705603	10.294397	10.049798	9.950202	5		20	
41	15	9.655867	10.344133	9.705681	10.294319	10.049814	9.950186	45		19	
42	30	9.655929	10.344071	9.705759	10.294241	10.049830	9.950170	30		18	
43	45	9.655991	10.344009	9.705837	10.294163	10.049846	9.950154	15		17	
44	56	9.656054	10.343946	9.705916	10.294084	10.049862	9.950138	4		16	
45	15	9.656116	10.343884	9.705994	10.294006	10.049878	9.950122	45		15	
46	30	9.656178	10.343822	9.706072	10.293928	10.049894	9.950106	30		14	
47	45	9.656240	10.343760	9.706150	10.293850	10.049910	9.950090	15		13	
48	57	9.656302	10.343698	9.706228	10.293772	10.049926	9.950074	3		12	
49	15	9.656364	10.343636	9.706306	10.293694	10.049942	9.950058	45		11	
50	30	9.656426	10.343574	9.706385	10.293615	10.049958	9.950042	30		10	
51	45	9.656488	10.343512	9.706463	10.293537	10.049974	9.950026	15		9	
52	58	9.656550	10.343450	9.706541	10.293459	10.049991	9.950009	2		8	
53	15	9.656613	10.343387	9.706619	10.293381	10.050007	9.949993	45		7	
54	30	9.656675	10.343325	9.706697	10.293303	10.050023	9.949977	30		6	
55	45	9.656737	10.343263	9.706775	10.293225	10.050039	9.949961	15		5	
56	59	9.656799	10.343201	9.706853	10.293147	10.050055	9.949945	1		4	
57	15	9.656861	10.343139	9.706932	10.293068	10.050071	9.949929	45		3	
58	30	9.656923	10.343077	9.707010	10.292990	10.050087	9.949913	30		2	
59	45	9.656985	10.343015	9.707088	10.292912	10.050103	9.949897	15		1	
60	60	9.657047	10.342953	9.707166	10.292834	10.050119	9.949881	0		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
4 ⁿ 12 ^m .			LOG. SINES, &c.						63 deg.		

4ⁿ 12^m.

LOG. SINES, &c.

63 deg.

1 48 ^m .		LOG. SINES, &c. (t.)						27 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.657047	10.342953	9.707166	10.292334	10.050119	9.949881	60	60
1	15	9.657109	10.342891	9.707244	10.292756	10.050135	9.949865	45	59
2	30	9.657171	10.342829	9.707322	10.292678	10.050151	9.949849	30	58
3	45	9.657233	10.342767	9.707400	10.292600	10.050167	9.949833	15	57
4	1	9.657295	10.342705	9.707478	10.292522	10.050184	9.949816	59	56
5	15	9.657356	10.342644	9.707556	10.292444	10.050200	9.949800	45	55
6	30	9.657418	10.342582	9.707634	10.292366	10.050216	9.949784	30	54
7	45	9.657480	10.342520	9.707712	10.292288	10.050232	9.949768	15	53
8	2	9.657542	10.342458	9.707790	10.292210	10.050248	9.949752	58	52
9	15	9.657604	10.342396	9.707868	10.292132	10.050264	9.949736	45	51
10	30	9.657666	10.342334	9.707946	10.292054	10.050280	9.949720	30	50
11	45	9.657728	10.342272	9.708024	10.291976	10.050296	9.949704	15	49
12	3	9.657790	10.342210	9.708102	10.291898	10.050312	9.949688	57	48
13	15	9.657852	10.342148	9.708180	10.291820	10.050329	9.949671	45	47
14	30	9.657913	10.342087	9.708258	10.291742	10.050345	9.949655	30	46
15	45	9.657975	10.342025	9.708336	10.291664	10.050361	9.949639	15	45
16	4	9.658037	10.341963	9.708414	10.291586	10.050377	9.949623	56	44
17	15	9.658099	10.341901	9.708492	10.291508	10.050393	9.949607	45	43
18	30	9.658161	10.341839	9.708570	10.291430	10.050409	9.949591	30	42
19	45	9.658222	10.341778	9.708648	10.291352	10.050425	9.949575	15	41
20	5	9.658284	10.341716	9.708726	10.291274	10.050442	9.949558	55	40
21	15	9.658346	10.341654	9.708804	10.291196	10.050458	9.949542	45	39
22	30	9.658408	10.341592	9.708882	10.291118	10.050474	9.949526	30	38
23	45	9.658469	10.341531	9.708959	10.291041	10.050490	9.949510	15	37
24	6	9.658531	10.341469	9.709037	10.290963	10.050506	9.949494	54	36
25	15	9.658593	10.341407	9.709115	10.290885	10.050522	9.949478	45	35
26	30	9.658655	10.341345	9.709193	10.290807	10.050539	9.949461	30	34
27	45	9.658716	10.341284	9.709271	10.290729	10.050555	9.949445	15	33
28	7	9.658778	10.341222	9.709349	10.290651	10.050571	9.949429	53	32
29	15	9.658840	10.341160	9.709427	10.290573	10.050587	9.949413	45	31
30	30	9.658901	10.341099	9.709504	10.290496	10.050603	9.949397	30	30
31	45	9.658963	10.341037	9.709582	10.290418	10.050619	9.949381	15	29
32	8	9.659025	10.340975	9.709660	10.290340	10.050636	9.949364	52	28
33	15	9.659086	10.340914	9.709738	10.290262	10.050652	9.949348	45	27
34	30	9.659148	10.340852	9.709816	10.290184	10.050668	9.949332	30	26
35	45	9.659209	10.340791	9.709893	10.290107	10.050684	9.949316	15	25
36	9	9.659271	10.340729	9.709971	10.290029	10.050700	9.949300	51	24
37	15	9.659333	10.340667	9.710049	10.289951	10.050717	9.949283	45	23
38	30	9.659394	10.340606	9.710127	10.289873	10.050733	9.949267	30	22
39	45	9.659456	10.340544	9.710205	10.289795	10.050749	9.949251	15	21
40	10	9.659517	10.340483	9.710282	10.289718	10.050765	9.949235	50	20
41	15	9.659579	10.340421	9.710360	10.289640	10.050781	9.949219	45	19
42	30	9.659640	10.340360	9.710438	10.289562	10.050798	9.949202	30	18
43	45	9.659702	10.340298	9.710516	10.289484	10.050814	9.949186	15	17
44	11	9.659763	10.340237	9.710593	10.289407	10.050830	9.949170	49	16
45	15	9.659825	10.340175	9.710671	10.289329	10.050846	9.949154	45	15
46	30	9.659886	10.340114	9.710749	10.289251	10.050862	9.949138	30	14
47	45	9.659948	10.340052	9.710826	10.289174	10.050879	9.949121	15	13
48	12	9.660009	10.339991	9.710904	10.289096	10.050895	9.949105	48	12
49	15	9.660071	10.339929	9.710982	10.289018	10.050911	9.949089	45	11
50	30	9.660132	10.339868	9.711059	10.288941	10.050927	9.949073	30	10
51	45	9.660194	10.339806	9.711137	10.288863	10.050944	9.949056	15	9
52	13	9.660255	10.339745	9.711215	10.288785	10.050960	9.949040	47	8
53	15	9.660316	10.339684	9.711292	10.288708	10.050976	9.949024	45	7
54	30	9.660378	10.339622	9.711370	10.288630	10.050992	9.949008	30	6
55	45	9.660439	10.339561	9.711448	10.288552	10.051009	9.948991	15	5
56	14	9.660500	10.339500	9.711525	10.288475	10.051025	9.948975	46	4
57	15	9.660562	10.339438	9.711603	10.288397	10.051041	9.948959	45	3
58	30	9.660623	10.339377	9.711681	10.288319	10.051057	9.948943	30	2
59	45	9.660685	10.339315	9.711758	10.288242	10.051074	9.948926	15	1
60	15	9.660746	10.339254	9.711836	10.288164	10.051090	9.948910	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ⁿ 11 ^m .		LOG. SINES, &c.						62 deg.	

1 ^h 49 ^m .		LOG. SINES, &c. (t.)						27 deg.	
	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.660746	10.339254	9.711836	10.288164	10.051090	9.948910	45	60
1	15	9.660807	10.339193	9.711913	10.288087	10.051106	9.948894	45	59
2	30	9.660868	10.339132	9.711991	10.288009	10.051122	9.948878	30	58
3	45	9.660930	10.339070	9.712068	10.287932	10.051139	9.948861	15	57
4	16	9.660991	10.339009	9.712146	10.287854	10.051155	9.948845	44	56
5	15	9.661052	10.338948	9.712224	10.287776	10.051171	9.948829	45	55
6	30	9.661114	10.338886	9.712301	10.287699	10.051188	9.948812	30	50
7	45	9.661175	10.338825	9.712379	10.287621	10.051204	9.948796	15	53
8	17	9.661236	10.338764	9.712456	10.287544	10.051220	9.948780	43	52
9	15	9.661297	10.338703	9.712534	10.287466	10.051236	9.948764	45	51
10	30	9.661359	10.338641	9.712611	10.287389	10.051253	9.948747	30	50
11	45	9.661420	10.338580	9.712689	10.287311	10.051269	9.948731	15	49
12	18	9.661481	10.338519	9.712766	10.287234	10.051285	9.948715	42	48
13	15	9.661542	10.338458	9.712844	10.287156	10.051302	9.948698	45	47
14	30	9.661603	10.338397	9.712921	10.287079	10.051318	9.948682	30	46
15	45	9.661664	10.338336	9.712999	10.287001	10.051334	9.948666	15	45
16	19	9.661726	10.338274	9.713076	10.286924	10.051351	9.948649	41	44
17	15	9.661787	10.338213	9.713154	10.286846	10.051367	9.948633	45	43
18	30	9.661848	10.338152	9.713231	10.286769	10.051383	9.948617	30	42
19	45	9.661909	10.338091	9.713308	10.286692	10.051399	9.948601	15	41
20	20	9.661970	10.338030	9.713386	10.286614	10.051416	9.948584	40	40
21	15	9.662031	10.337969	9.713463	10.286537	10.051432	9.948568	45	39
22	30	9.662092	10.337908	9.713541	10.286459	10.051448	9.948552	30	38
23	45	9.662153	10.337847	9.713618	10.286382	10.051465	9.948535	15	37
24	21	9.662214	10.337786	9.713696	10.286304	10.051481	9.948519	39	36
25	15	9.662275	10.337725	9.713773	10.286227	10.051497	9.948503	45	35
26	30	9.662337	10.337663	9.713850	10.286150	10.051514	9.948486	30	34
27	45	9.662398	10.337602	9.713928	10.286072	10.051530	9.948470	15	33
28	22	9.662459	10.337541	9.714005	10.285995	10.051547	9.948453	38	32
29	15	9.662520	10.337480	9.714082	10.285918	10.051563	9.948437	45	31
30	30	9.662581	10.337419	9.714160	10.285840	10.051579	9.948421	30	30
31	45	9.662642	10.337358	9.714237	10.285763	10.051596	9.948404	15	29
32	23	9.662703	10.337297	9.714314	10.285686	10.051612	9.948388	37	28
33	15	9.662764	10.337236	9.714392	10.285608	10.051628	9.948372	45	27
34	30	9.662824	10.337176	9.714469	10.285531	10.051645	9.948355	30	26
35	45	9.662885	10.337115	9.714546	10.285454	10.051661	9.948339	15	25
36	24	9.662946	10.337054	9.714624	10.285376	10.051677	9.948323	36	24
37	15	9.663007	10.336993	9.714701	10.285299	10.051694	9.948306	45	23
38	30	9.663068	10.336932	9.714778	10.285222	10.051710	9.948290	30	22
39	45	9.663129	10.336871	9.714856	10.285144	10.051727	9.948273	15	21
40	25	9.663190	10.336810	9.714933	10.285067	10.051743	9.948257	35	20
41	15	9.663251	10.336749	9.715010	10.284990	10.051759	9.948241	45	19
42	30	9.663312	10.336688	9.715087	10.284913	10.051776	9.948224	30	18
43	45	9.663373	10.336627	9.715165	10.284835	10.051792	9.948208	15	17
44	26	9.663433	10.336567	9.715242	10.284758	10.051808	9.948192	34	16
45	15	9.663494	10.336506	9.715319	10.284681	10.051825	9.948175	45	15
46	30	9.663555	10.336445	9.715396	10.284604	10.051841	9.948159	30	14
47	45	9.663616	10.336384	9.715474	10.284526	10.051858	9.948142	15	13
48	27	9.663677	10.336323	9.715551	10.284449	10.051874	9.948126	33	12
49	15	9.663738	10.336262	9.715628	10.284372	10.051890	9.948110	45	11
50	30	9.663798	10.336202	9.715705	10.284295	10.051907	9.948093	30	10
51	45	9.663859	10.336141	9.715782	10.284218	10.051923	9.948077	15	9
52	28	9.663920	10.336080	9.715859	10.284141	10.051940	9.948060	32	8
53	15	9.663981	10.336019	9.715937	10.284063	10.051956	9.948044	45	7
54	30	9.664041	10.335959	9.716014	10.283986	10.051973	9.948027	30	6
55	45	9.664102	10.335898	9.716091	10.283909	10.051989	9.948011	15	5
56	29	9.664163	10.335837	9.716168	10.283832	10.052005	9.947995	31	4
57	15	9.664223	10.335777	9.716245	10.283755	10.052022	9.947978	45	3
58	30	9.664284	10.335716	9.716322	10.283678	10.052038	9.947962	30	2
59	45	9.664345	10.335655	9.716400	10.283600	10.052055	9.947945	15	1
60	30	9.664406	10.335594	9.716477	10.283523	10.052071	9.947929	30	0
sec.	"	cosine	secant.	cotangent.	tangent	cosecant.	sine.	"	sec.
4 ^h 10 ^m .		LOG. SINES, &c.						62 deg.	

1 ^h 50 ^m .				LOG. SINES, &c. (t.)				27 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.	
0	30	9.664406	10.335594	9.716477	10.283523	10.052071	9.947929	30		60	
1	15	9.664466	10.335534	9.716554	10.283446	10.052088	9.947912	45		59	
2	30	9.664527	10.335473	9.716631	10.283369	10.052104	9.947896	30		58	
3	45	9.664588	10.335412	9.716708	10.283292	10.052120	9.947880	15		57	
4	31	9.664648	10.335352	9.716785	10.283215	10.052137	9.947863		29	56	
5	15	9.664709	10.335291	9.716862	10.283138	10.052153	9.947847	45		55	
6	30	9.664769	10.335231	9.716939	10.283061	10.052170	9.947830	30		54	
7	45	9.664830	10.335170	9.717016	10.282984	10.052186	9.947814	15		53	
8	32	9.664891	10.335109	9.717093	10.282907	10.052203	9.947797		28	52	
9	15	9.664951	10.335049	9.717170	10.282830	10.052219	9.947781	45		51	
10	30	9.665012	10.334988	9.717247	10.282753	10.052236	9.947764	30		50	
11	45	9.665072	10.334928	9.717324	10.282676	10.052252	9.947748	15		49	
12	33	9.665133	10.334867	9.717401	10.282599	10.052269	9.947731		27	48	
13	15	9.665193	10.334807	9.717478	10.282522	10.052285	9.947715	45		47	
14	30	9.665254	10.334746	9.717555	10.282445	10.052302	9.947698	30		46	
15	45	9.665314	10.334686	9.717632	10.282368	10.052318	9.947682	15		45	
16	34	9.665375	10.334625	9.717709	10.282291	10.052335	9.947665		26	44	
17	15	9.665435	10.334565	9.717786	10.282214	10.052351	9.947649	45		43	
18	30	9.665496	10.334504	9.717863	10.282137	10.052368	9.947632	30		42	
19	45	9.665556	10.334444	9.717940	10.282060	10.052384	9.947616	15		41	
20	35	9.665617	10.334383	9.718017	10.281983	10.052401	9.947599		25	40	
21	15	9.665677	10.334323	9.718094	10.281906	10.052417	9.947583	45		39	
22	30	9.665738	10.334262	9.718171	10.281829	10.052434	9.947566	30		38	
23	45	9.665798	10.334202	9.718248	10.281752	10.052450	9.947550	15		37	
24	36	9.665859	10.334141	9.718325	10.281675	10.052467	9.947533		24	36	
25	15	9.665919	10.334081	9.718402	10.281598	10.052483	9.947517	45		35	
26	30	9.665979	10.334021	9.718479	10.281521	10.052500	9.947500	30		34	
27	45	9.666040	10.333960	9.718556	10.281444	10.052516	9.947484	15		33	
28	37	9.666100	10.333900	9.718633	10.281367	10.052533	9.947467		23	32	
29	15	9.666160	10.333840	9.718710	10.281290	10.052549	9.947451	45		31	
30	30	9.666221	10.333779	9.718786	10.281214	10.052566	9.947434	30		30	
31	45	9.666281	10.333719	9.718863	10.281137	10.052582	9.947418	15		29	
32	38	9.666341	10.333659	9.718940	10.281060	10.052599	9.947401		22	28	
33	15	9.666402	10.333598	9.719017	10.280983	10.052615	9.947385	45		27	
34	30	9.666462	10.333538	9.719094	10.280906	10.052632	9.947368	30		26	
35	45	9.666522	10.333478	9.719171	10.280829	10.052648	9.947352	15		25	
36	39	9.666583	10.333417	9.719248	10.280752	10.052665	9.947335		21	24	
37	15	9.666643	10.333357	9.719324	10.280676	10.052681	9.947319	45		23	
38	30	9.666703	10.333297	9.719401	10.280599	10.052698	9.947302	30		22	
39	45	9.666764	10.333236	9.719478	10.280522	10.052715	9.947285	15		21	
40	40	9.666824	10.333176	9.719555	10.280445	10.052731	9.947269		20	20	
41	15	9.666884	10.333116	9.719632	10.280368	10.052748	9.947252	45		19	
42	30	9.666944	10.333056	9.719708	10.280292	10.052764	9.947236	30		18	
43	45	9.667004	10.332996	9.719785	10.280215	10.052781	9.947219	15		17	
44	41	9.667065	10.332935	9.719862	10.280138	10.052797	9.947203		19	16	
45	15	9.667125	10.332875	9.719939	10.280061	10.052814	9.947186	45		15	
46	30	9.667185	10.332815	9.720015	10.279985	10.052831	9.947169	30		14	
47	45	9.667245	10.332755	9.720092	10.279908	10.052847	9.947153	15		13	
48	42	9.667305	10.332695	9.720169	10.279831	10.052864	9.947136		18	12	
49	15	9.667366	10.332634	9.720246	10.279754	10.052880	9.947120	45		11	
50	30	9.667426	10.332574	9.720322	10.279678	10.052897	9.947103	30		10	
51	45	9.667486	10.332514	9.720399	10.279601	10.052913	9.947087	15		9	
52	43	9.667546	10.332454	9.720476	10.279524	10.052930	9.947070		17	8	
53	15	9.667606	10.332394	9.720553	10.279447	10.052947	9.947053	45		7	
54	30	9.667666	10.332334	9.720629	10.279371	10.052963	9.947037	30		6	
55	45	9.667726	10.332274	9.720706	10.279294	10.052980	9.947020	15		5	
56	44	9.667786	10.332214	9.720783	10.279217	10.052996	9.947004		16	4	
57	15	9.667846	10.332154	9.720859	10.279141	10.053013	9.946987	45		3	
58	30	9.667906	10.332094	9.720936	10.279064	10.053030	9.946970	30		2	
59	45	9.667966	10.332034	9.721013	10.278987	10.053046	9.946954	15		1	
60	45	9.668026	10.331974	9.721089	10.278911	10.053063	9.946937		15	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.	
4 ^h 9 ^m .				LOG. SINES, &c.				62 deg.			

1 ^h 51 ^m .			LOG. SINES, &c. (t.)				27 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.668026	10.331974	9.721089	10.278911	10.053063	9.946937	15	60
1	15	9.668086	10.331914	9.721166	10.278834	10.053079	9.946921	45	59
2	30	9.668147	10.331853	9.721243	10.278757	10.053096	9.946904	30	58
3	45	9.668207	10.331793	9.721319	10.278681	10.053113	9.946887	15	57
4	46	9.668266	10.331734	9.721396	10.278604	10.053129	9.946871	14	56
5	15	9.668326	10.331674	9.721472	10.278528	10.053146	9.946854	45	55
6	30	9.668386	10.331614	9.721549	10.278451	10.053163	9.946837	30	54
7	45	9.668446	10.331554	9.721626	10.278374	10.053179	9.946821	15	53
8	47	9.668506	10.331494	9.721702	10.278298	10.053196	9.946804	13	52
9	15	9.668566	10.331434	9.721779	10.278221	10.053213	9.946787	45	51
10	30	9.668626	10.331374	9.721855	10.278145	10.053229	9.946771	30	50
11	45	9.668686	10.331314	9.721932	10.278068	10.053246	9.946754	15	49
12	48	9.668746	10.331254	9.722008	10.277992	10.053262	9.946738	12	48
13	15	9.668806	10.331194	9.722085	10.277915	10.053279	9.946721	45	47
14	30	9.668866	10.331134	9.722162	10.277838	10.053296	9.946704	30	46
15	45	9.668926	10.331074	9.722238	10.277762	10.053312	9.946688	15	45
16	49	9.668986	10.331014	9.722315	10.277685	10.053329	9.946671	11	44
17	15	9.669045	10.330955	9.722391	10.277609	10.053346	9.946654	45	43
18	30	9.669105	10.330895	9.722468	10.277532	10.053362	9.946638	30	42
19	45	9.669165	10.330835	9.722544	10.277456	10.053379	9.946621	15	41
20	50	9.669225	10.330775	9.722621	10.277379	10.053396	9.946604	10	40
21	15	9.669285	10.330715	9.722697	10.277303	10.053412	9.946588	45	39
22	30	9.669345	10.330655	9.722774	10.277226	10.053429	9.946571	30	38
23	45	9.669404	10.330596	9.722850	10.277150	10.053446	9.946554	15	37
24	51	9.669464	10.330536	9.722927	10.277073	10.053462	9.946538	9	36
25	15	9.669524	10.330476	9.723003	10.276997	10.053479	9.946521	45	35
26	30	9.669584	10.330416	9.723079	10.276921	10.053496	9.946504	30	34
27	45	9.669643	10.330357	9.723156	10.276844	10.053513	9.946487	15	33
28	52	9.669703	10.330297	9.723232	10.276768	10.053529	9.946471	8	32
29	15	9.669763	10.330237	9.723309	10.276691	10.053546	9.946454	45	31
30	30	9.669823	10.330177	9.723385	10.276615	10.053563	9.946437	30	30
31	45	9.669882	10.330118	9.723462	10.276538	10.053579	9.946421	15	29
32	53	9.669942	10.330058	9.723538	10.276462	10.053596	9.946404	7	28
33	15	9.670002	10.329998	9.723614	10.276386	10.053613	9.946387	45	27
34	30	9.670061	10.329939	9.723691	10.276309	10.053630	9.946370	30	26
35	45	9.670121	10.329879	9.723767	10.276233	10.053646	9.946354	15	25
36	54	9.670181	10.329819	9.723844	10.276156	10.053663	9.946337	6	24
37	15	9.670240	10.329760	9.723920	10.276080	10.053680	9.946320	45	23
38	30	9.670300	10.329700	9.723996	10.276004	10.053696	9.946304	30	22
39	45	9.670360	10.329640	9.724073	10.275927	10.053713	9.946287	15	21
40	55	9.670419	10.329581	9.724149	10.275851	10.053730	9.946270	5	20
41	15	9.670479	10.329521	9.724225	10.275775	10.053747	9.946253	45	19
42	30	9.670538	10.329462	9.724302	10.275698	10.053763	9.946237	30	18
43	45	9.670598	10.329402	9.724378	10.275622	10.053780	9.946220	15	17
44	56	9.670658	10.329342	9.724454	10.275546	10.053797	9.946203	4	16
45	15	9.670717	10.329283	9.724531	10.275469	10.053814	9.946186	45	15
46	30	9.670777	10.329223	9.724607	10.275393	10.053830	9.946170	30	14
47	45	9.670836	10.329164	9.724683	10.275317	10.053847	9.946153	15	13
48	57	9.670896	10.329104	9.724759	10.275241	10.053864	9.946136	3	12
49	15	9.670955	10.329045	9.724836	10.275164	10.053881	9.946119	45	11
50	30	9.671015	10.328985	9.724912	10.275088	10.053897	9.946103	30	10
51	45	9.671074	10.328926	9.724988	10.275012	10.053914	9.946086	15	9
52	58	9.671134	10.328866	9.725065	10.274935	10.053931	9.946069	2	8
53	15	9.671193	10.328807	9.725141	10.274859	10.053948	9.946052	45	7
54	30	9.671253	10.328747	9.725217	10.274783	10.053964	9.946036	30	6
55	45	9.671312	10.328688	9.725293	10.274707	10.053981	9.946019	15	5
56	59	9.671372	10.328628	9.725369	10.274631	10.053998	9.946002	1	4
57	15	9.671431	10.328569	9.725446	10.274554	10.054015	9.945986	45	3
58	30	9.671490	10.328510	9.725522	10.274478	10.054032	9.945969	30	2
59	45	9.671550	10.328450	9.725598	10.274402	10.054048	9.945952	15	1
60	60	9.671609	10.328391	9.725674	10.274326	10.054065	9.945935	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 8 ^m .			LOG. SINES, &c.				62 deg.		

4^h 8^m.

LOG. SINES, &c.

62 deg.

1 ^h 52 ^m .		LOG. SINES, &c. (t.)						28 deg.	
sec.	'	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.671609	10.328391	9.725674	10.274326	10.054065	9.945935	60	60
1	15	9.671669	10.328331	9.725751	10.274249	10.054062	9.945918	45	59
2	30	9.671728	10.328272	9.725827	10.274173	10.054099	9.945901	30	58
3	45	9.671787	10.328213	9.725903	10.274097	10.054116	9.945884	15	57
4	1	9.671847	10.328153	9.725979	10.274021	10.054132	9.945868	59	56
5	15	9.671906	10.328094	9.726055	10.273945	10.054149	9.945851	45	55
6	30	9.671965	10.328035	9.726131	10.273869	10.054166	9.945834	30	54
7	45	9.672025	10.327975	9.726207	10.273793	10.054183	9.945817	15	53
8	2	9.672084	10.327916	9.726284	10.273716	10.054200	9.945800	58	52
9	15	9.672143	10.327857	9.726360	10.273640	10.054216	9.945784	45	51
10	30	9.672203	10.327797	9.726436	10.273564	10.054233	9.945767	30	50
11	45	9.672262	10.327738	9.726512	10.273488	10.054250	9.945750	15	49
12	3	9.672321	10.327679	9.726588	10.273412	10.054267	9.945733	57	48
13	15	9.672381	10.327619	9.726664	10.273336	10.054284	9.945716	45	47
14	30	9.672440	10.327560	9.726740	10.273260	10.054301	9.945699	30	46
15	45	9.672499	10.327501	9.726816	10.273184	10.054317	9.945683	15	45
16	4	9.672558	10.327442	9.726892	10.273108	10.054334	9.945666	56	44
17	15	9.672618	10.327382	9.726968	10.273032	10.054351	9.945649	45	43
18	30	9.672677	10.327323	9.727045	10.272955	10.054368	9.945632	30	42
19	45	9.672736	10.327264	9.727121	10.272879	10.054385	9.945615	15	41
20	5	9.672795	10.327205	9.727197	10.272803	10.054402	9.945598	55	40
21	15	9.672854	10.327146	9.727273	10.272727	10.054418	9.945582	45	39
22	30	9.672913	10.327087	9.727349	10.272651	10.054435	9.945565	30	38
23	45	9.672973	10.327027	9.727425	10.272575	10.054452	9.945548	15	37
24	6	9.673032	10.326968	9.727501	10.272499	10.054469	9.945531	54	36
25	15	9.673091	10.326909	9.727577	10.272423	10.054486	9.945514	45	35
26	30	9.673150	10.326850	9.727653	10.272347	10.054503	9.945497	30	34
27	45	9.673209	10.326791	9.727729	10.272271	10.054520	9.945480	15	33
28	7	9.673268	10.326732	9.727805	10.272195	10.054536	9.945464	53	32
29	15	9.673327	10.326673	9.727881	10.272119	10.054553	9.945447	45	31
30	30	9.673387	10.326613	9.727957	10.272043	10.054570	9.945430	30	30
31	45	9.673446	10.326554	9.728033	10.271967	10.054587	9.945413	15	29
32	8	9.673505	10.326495	9.728109	10.271891	10.054604	9.945396	52	28
33	15	9.673564	10.326436	9.728185	10.271815	10.054621	9.945379	45	27
34	30	9.673623	10.326377	9.728261	10.271739	10.054638	9.945362	30	26
35	45	9.673682	10.326318	9.728336	10.271664	10.054655	9.945345	15	25
36	9	9.673741	10.326259	9.728412	10.271588	10.054672	9.945328	51	24
37	15	9.673800	10.326200	9.728488	10.271512	10.054688	9.945312	45	23
38	30	9.673859	10.326141	9.728564	10.271436	10.054705	9.945295	30	22
39	45	9.673918	10.326082	9.728640	10.271360	10.054722	9.945278	15	21
40	10	9.673977	10.326023	9.728716	10.271284	10.054739	9.945261	50	20
41	15	9.674036	10.325964	9.728792	10.271208	10.054756	9.945244	45	19
42	30	9.674095	10.325905	9.728868	10.271132	10.054773	9.945227	30	18
43	45	9.674154	10.325846	9.728944	10.271056	10.054790	9.945210	15	17
44	11	9.674213	10.325787	9.729020	10.270980	10.054807	9.945193	49	16
45	15	9.674272	10.325728	9.729095	10.270905	10.054824	9.945176	45	15
46	30	9.674331	10.325669	9.729171	10.270829	10.054841	9.945159	30	14
47	45	9.674390	10.325610	9.729247	10.270753	10.054858	9.945142	15	13
48	12	9.674448	10.325552	9.729323	10.270677	10.054875	9.945125	48	12
49	15	9.674507	10.325493	9.729399	10.270601	10.054892	9.945108	45	11
50	30	9.674566	10.325434	9.729475	10.270525	10.054908	9.945092	30	10
51	45	9.674625	10.325375	9.729550	10.270450	10.054925	9.945075	15	9
52	13	9.674684	10.325316	9.729626	10.270374	10.054942	9.945058	47	8
53	15	9.674743	10.325257	9.729702	10.270298	10.054959	9.945041	45	7
54	30	9.674802	10.325198	9.729778	10.270222	10.054976	9.945024	30	6
55	45	9.674860	10.325140	9.729854	10.270146	10.054993	9.945007	15	5
56	14	9.674919	10.325081	9.729929	10.270071	10.055010	9.944990	46	4
57	15	9.674978	10.325022	9.730005	10.269995	10.055027	9.944973	45	3
58	30	9.675037	10.324963	9.730081	10.269919	10.055044	9.944956	30	2
59	45	9.675096	10.324904	9.730157	10.269843	10.055061	9.944939	15	1
60	15	9.675155	10.324845	9.730232	10.269768	10.055078	9.944922	45	0
sec.	'	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 7 ^m .		LOG. SINES, &c.						61 deg.	

1 ^h 53 ^m .		LOG. SINES, &c. (t.)						28 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.675155	10.324845	9.730232	10.269768	10.055078	9.944922	45	60
1	15	9.675213	10.324787	9.730308	10.269692	10.055095	9.944905	45	59
2	30	9.675272	10.324728	9.730384	10.269616	10.055112	9.944888	30	58
3	45	9.675331	10.324669	9.730460	10.269540	10.055129	9.944871	15	57
4	16	9.675390	10.324610	9.730535	10.269465	10.055146	9.944854	44	56
5	15	9.675448	10.324552	9.730611	10.269389	10.055163	9.944837	45	55
6	30	9.675507	10.324493	9.730687	10.269313	10.055180	9.944820	30	54
7	45	9.675566	10.324434	9.730763	10.269237	10.055197	9.944803	15	53
8	17	9.675624	10.324376	9.730838	10.269162	10.055214	9.944786	43	52
9	15	9.675683	10.324317	9.730914	10.269086	10.055231	9.944769	45	51
10	30	9.675742	10.324258	9.730990	10.269010	10.055248	9.944752	30	50
11	45	9.675800	10.324200	9.731065	10.268935	10.055265	9.944735	15	49
12	18	9.675859	10.324141	9.731141	10.268859	10.055282	9.944718	42	48
13	15	9.675918	10.324082	9.731217	10.268783	10.055299	9.944701	45	47
14	30	9.675976	10.324024	9.731292	10.268708	10.055316	9.944684	30	46
15	45	9.676035	10.323965	9.731368	10.268632	10.055333	9.944667	15	45
16	19	9.676094	10.323906	9.731444	10.268556	10.055350	9.944650	41	44
17	15	9.676152	10.323848	9.731519	10.268481	10.055367	9.944633	45	43
18	30	9.676211	10.323789	9.731595	10.268405	10.055384	9.944616	30	42
19	45	9.676269	10.323731	9.731670	10.268330	10.055401	9.944599	15	41
20	20	9.676328	10.323672	9.731746	10.268254	10.055418	9.944582	40	40
21	15	9.676387	10.323613	9.731822	10.268178	10.055435	9.944565	45	39
22	30	9.676445	10.323555	9.731897	10.268103	10.055452	9.944548	30	38
23	45	9.676504	10.323496	9.731973	10.268027	10.055469	9.944531	15	37
24	21	9.676562	10.323438	9.732048	10.267952	10.055486	9.944514	39	36
25	15	9.676621	10.323379	9.732124	10.267876	10.055503	9.944497	45	35
26	30	9.676679	10.323321	9.732199	10.267801	10.055520	9.944480	30	34
27	45	9.676738	10.323262	9.732275	10.267725	10.055537	9.944463	15	33
28	22	9.676796	10.323204	9.732351	10.267649	10.055554	9.944446	38	32
29	15	9.676855	10.323145	9.732426	10.267574	10.055571	9.944429	45	31
30	30	9.676913	10.323087	9.732502	10.267498	10.055588	9.944412	30	30
31	45	9.676972	10.323028	9.732577	10.267423	10.055605	9.944394	15	29
32	23	9.677030	10.322970	9.732653	10.267347	10.055623	9.944377	37	28
33	15	9.677089	10.322911	9.732728	10.267272	10.055640	9.944360	45	27
34	30	9.677147	10.322853	9.732804	10.267196	10.055657	9.944343	30	26
35	45	9.677205	10.322795	9.732879	10.267121	10.055674	9.944326	15	25
36	24	9.677264	10.322736	9.732955	10.267045	10.055691	9.944309	36	24
37	15	9.677322	10.322678	9.733030	10.266970	10.055708	9.944292	45	23
38	30	9.677381	10.322619	9.733106	10.266894	10.055725	9.944275	30	22
39	45	9.677439	10.322561	9.733181	10.266819	10.055742	9.944258	15	21
40	25	9.677497	10.322503	9.733257	10.266743	10.055759	9.944241	35	20
41	15	9.677556	10.322444	9.733332	10.266668	10.055776	9.944224	45	19
42	30	9.677614	10.322386	9.733407	10.266593	10.055793	9.944207	30	18
43	45	9.677673	10.322327	9.733483	10.266517	10.055810	9.944190	15	17
44	26	9.677731	10.322269	9.733558	10.266442	10.055828	9.944172	34	16
45	15	9.677789	10.322211	9.733634	10.266366	10.055845	9.944155	45	15
46	30	9.677848	10.322152	9.733709	10.266291	10.055862	9.944138	30	14
47	45	9.677906	10.322094	9.733785	10.266215	10.055879	9.944121	15	13
48	27	9.677964	10.322036	9.733860	10.266140	10.055896	9.944104	33	12
49	15	9.678022	10.321978	9.733935	10.266065	10.055913	9.944087	45	11
50	30	9.678081	10.321919	9.734011	10.265989	10.055930	9.944070	30	10
51	45	9.678139	10.321861	9.734086	10.265914	10.055947	9.944053	15	9
52	28	9.678197	10.321803	9.734162	10.265838	10.055964	9.944036	32	8
53	15	9.678255	10.321745	9.734237	10.265763	10.055982	9.944018	45	7
54	30	9.678314	10.321686	9.734312	10.265688	10.055999	9.944001	30	6
55	45	9.678372	10.321628	9.734388	10.265612	10.056016	9.943984	15	5
56	29	9.678430	10.321570	9.734463	10.265537	10.056033	9.943967	31	4
57	15	9.678488	10.321512	9.734538	10.265462	10.056050	9.943950	45	3
58	30	9.678546	10.321454	9.734614	10.265386	10.056067	9.943933	30	2
59	45	9.678605	10.321395	9.734689	10.265311	10.056084	9.943916	15	1
60	30	9.678663	10.321337	9.734764	10.265236	10.056102	9.943898	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 6 ^m .		LOG. SINES, &c						61 deg.	

1 ^h 54 ^m .		LOG. SINES, &c. (t.)						28 deg.	
sec.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.678663	10.321337	9.734764	10.265236	10.056102	9.943898	30	60
1	15	9.678721	10.321279	9.734840	10.265160	10.056119	9.943881	45	59
2	30	9.678779	10.321221	9.734915	10.265085	10.056136	9.943864	30	58
3	45	9.678837	10.321163	9.734990	10.265010	10.056153	9.943847	15	57
4	31	9.678895	10.321105	9.735066	10.264934	10.056170	9.943830	29	56
5	15	9.678954	10.321046	9.735141	10.264859	10.056187	9.943813	45	55
6	30	9.679012	10.320988	9.735216	10.264784	10.056204	9.943796	30	54
7	45	9.679070	10.320930	9.735291	10.264709	10.056222	9.943778	15	53
8	32	9.679128	10.320872	9.735367	10.264633	10.056239	9.943761	28	52
9	15	9.679186	10.320814	9.735442	10.264558	10.056256	9.943744	45	51
10	30	9.679244	10.320756	9.735517	10.264483	10.056273	9.943727	30	50
11	45	9.679302	10.320698	9.735592	10.264408	10.056290	9.943710	15	49
12	33	9.679360	10.320640	9.735668	10.264332	10.056308	9.943692	27	48
13	15	9.679418	10.320582	9.735743	10.264257	10.056325	9.943675	45	47
14	30	9.679476	10.320524	9.735818	10.264182	10.056342	9.943658	30	46
15	45	9.679534	10.320466	9.735893	10.264107	10.056359	9.943641	15	45
16	34	9.679592	10.320408	9.735968	10.264032	10.056376	9.943624	26	44
17	15	9.679650	10.320350	9.736044	10.263956	10.056393	9.943607	45	43
18	30	9.679708	10.320292	9.736119	10.263881	10.056411	9.943589	30	42
19	45	9.679766	10.320234	9.736194	10.263806	10.056428	9.943572	15	41
20	35	9.679824	10.320176	9.736269	10.263731	10.056445	9.943555	25	40
21	15	9.679882	10.320118	9.736344	10.263656	10.056462	9.943538	45	39
22	30	9.679940	10.320060	9.736420	10.263580	10.056480	9.943520	30	38
23	45	9.679998	10.320002	9.736495	10.263505	10.056497	9.943503	15	37
24	36	9.680056	10.319944	9.736570	10.263430	10.056514	9.943486	24	36
25	15	9.680114	10.319886	9.736645	10.263355	10.056531	9.943469	45	35
26	30	9.680172	10.319828	9.736720	10.263280	10.056548	9.943452	30	34
27	45	9.680230	10.319770	9.736795	10.263205	10.056566	9.943434	15	33
28	37	9.680288	10.319712	9.736870	10.263130	10.056583	9.943417	23	32
29	15	9.680345	10.319655	9.736946	10.263054	10.056600	9.943400	45	31
30	30	9.680403	10.319597	9.737021	10.262979	10.056617	9.943383	30	30
31	45	9.680461	10.319539	9.737096	10.262904	10.056635	9.943365	15	29
32	38	9.680519	10.319481	9.737171	10.262829	10.056652	9.943348	22	28
33	15	9.680577	10.319423	9.737246	10.262754	10.056669	9.943331	45	27
34	30	9.680635	10.319365	9.737321	10.262679	10.056686	9.943314	30	26
35	45	9.680693	10.319307	9.737396	10.262604	10.056704	9.943296	15	25
36	39	9.680750	10.319250	9.737471	10.262529	10.056721	9.943279	21	24
37	15	9.680808	10.319192	9.737546	10.262454	10.056738	9.943262	45	23
38	30	9.680866	10.319134	9.737621	10.262379	10.056755	9.943245	30	22
39	45	9.680924	10.319076	9.737696	10.262304	10.056773	9.943227	15	21
40	40	9.680982	10.319018	9.737771	10.262229	10.056790	9.943210	20	20
41	15	9.681039	10.318961	9.737846	10.262154	10.056807	9.943193	45	19
42	30	9.681097	10.318903	9.737921	10.262079	10.056824	9.943176	30	18
43	45	9.681155	10.318845	9.737996	10.262004	10.056842	9.943158	15	17
44	41	9.681213	10.318787	9.738071	10.261929	10.056859	9.943141	19	16
45	15	9.681270	10.318730	9.738146	10.261854	10.056876	9.943124	45	15
46	30	9.681328	10.318672	9.738221	10.261779	10.056894	9.943106	30	14
47	45	9.681386	10.318614	9.738296	10.261704	10.056911	9.943089	15	13
48	42	9.681443	10.318557	9.738371	10.261629	10.056928	9.943072	18	12
49	15	9.681501	10.318499	9.738446	10.261554	10.056945	9.943055	45	11
50	30	9.681559	10.318441	9.738521	10.261479	10.056963	9.943037	30	10
51	45	9.681616	10.318384	9.738596	10.261404	10.056980	9.943020	15	9
52	43	9.681674	10.318326	9.738671	10.261329	10.056997	9.943003	17	8
53	15	9.681732	10.318268	9.738746	10.261254	10.057015	9.942985	45	7
54	30	9.681789	10.318211	9.738821	10.261179	10.057032	9.942968	30	6
55	45	9.681847	10.318153	9.738896	10.261104	10.057049	9.942951	15	5
56	44	9.681905	10.318095	9.738971	10.261029	10.057067	9.942933	16	4
57	15	9.681962	10.318038	9.739046	10.260954	10.057084	9.942916	45	3
58	30	9.682020	10.317980	9.739121	10.260879	10.057101	9.942899	30	2
59	45	9.682077	10.317923	9.739196	10.260804	10.057118	9.942882	15	1
60	45	9.682135	10.317865	9.739271	10.260729	10.057136	9.942864	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 5 ^m .		LOG. SINES, &c.						61 deg.	

1° 55m.		LOG. SINES, &c. (t.)						28 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	45	9.682135	10.317865	9.739271	10.260729	10.057136	9.942864	15		60
1	15	9.682192	10.317808	9.739346	10.260654	10.057153	9.942847	45		59
2	30	9.682250	10.317750	9.739420	10.260580	10.057170	9.942830	30		58
3	45	9.682308	10.317692	9.739495	10.260505	10.057188	9.942812	15		57
4	46	9.682363	10.317635	9.739570	10.260430	10.057205	9.942795		14	56
5	15	9.682423	10.317577	9.739645	10.260355	10.057222	9.942778	45		55
6	30	9.682480	10.317520	9.739720	10.260280	10.057240	9.942760	30		54
7	45	9.682538	10.317462	9.739795	10.260205	10.057257	9.942743	15		53
8	47	9.682595	10.317405	9.739870	10.260130	10.057275	9.942725		13	52
9	15	9.682653	10.317347	9.739944	10.260056	10.057292	9.942708	45		51
10	30	9.682710	10.317290	9.740019	10.259981	10.057309	9.942691	30		50
11	45	9.682768	10.317232	9.740094	10.259906	10.057327	9.942673	15		49
12	48	9.682825	10.317175	9.740169	10.259831	10.057344	9.942656		12	48
13	15	9.682882	10.317118	9.740244	10.259756	10.057361	9.942639	45		47
14	30	9.682940	10.317060	9.740318	10.259682	10.057379	9.942621	30		46
15	45	9.682997	10.317003	9.740393	10.259607	10.057396	9.942604	15		45
16	49	9.683055	10.316945	9.740468	10.259532	10.057413	9.942587		11	44
17	15	9.683112	10.316888	9.740543	10.259457	10.057431	9.942569	45		43
18	30	9.683170	10.316830	9.740618	10.259382	10.057448	9.942552	30		42
19	45	9.683227	10.316773	9.740692	10.259308	10.057466	9.942534	15		41
20	50	9.683284	10.316716	9.740767	10.259233	10.057483	9.942517		10	40
21	15	9.683342	10.316658	9.740842	10.259158	10.057500	9.942500	45		39
22	30	9.683399	10.316601	9.740917	10.259083	10.057518	9.942482	30		38
23	45	9.683456	10.316544	9.740991	10.259009	10.057535	9.942465	15		37
24	51	9.683514	10.316486	9.741066	10.258934	10.057552	9.942448		9	36
25	15	9.683571	10.316429	9.741141	10.258859	10.057570	9.942430	45		35
26	30	9.683628	10.316372	9.741216	10.258784	10.057587	9.942413	30		34
27	45	9.683686	10.316314	9.741290	10.258710	10.057605	9.942395	15		33
28	52	9.683743	10.316257	9.741365	10.258635	10.057622	9.942378		8	32
29	15	9.683800	10.316200	9.741440	10.258560	10.057640	9.942360	45		31
30	30	9.683857	10.316143	9.741514	10.258486	10.057657	9.942343	30		30
31	45	9.683915	10.316085	9.741589	10.258411	10.057674	9.942326	15		29
32	53	9.683972	10.316028	9.741664	10.258336	10.057692	9.942308		7	28
33	15	9.684029	10.315971	9.741738	10.258262	10.057709	9.942291	45		27
34	30	9.684086	10.315914	9.741813	10.258187	10.057727	9.942273	30		26
35	45	9.684144	10.315856	9.741888	10.258112	10.057744	9.942256	15		25
36	54	9.684201	10.315799	9.741962	10.258038	10.057761	9.942239		6	24
37	15	9.684258	10.315742	9.742037	10.257963	10.057779	9.942221	45		23
38	30	9.684315	10.315685	9.742112	10.257888	10.057796	9.942204	30		22
39	45	9.684373	10.315627	9.742186	10.257814	10.057814	9.942186	15		21
40	55	9.684430	10.315570	9.742261	10.257739	10.057831	9.942169		5	20
41	15	9.684487	10.315513	9.742336	10.257664	10.057849	9.942151	45		19
42	30	9.684544	10.315456	9.742410	10.257590	10.057866	9.942134	30		18
43	45	9.684601	10.315399	9.742485	10.257515	10.057884	9.942116	15		17
44	56	9.684658	10.315342	9.742559	10.257441	10.057901	9.942099		4	16
45	15	9.684715	10.315285	9.742634	10.257366	10.057919	9.942081	45		15
46	30	9.684773	10.315227	9.742708	10.257292	10.057936	9.942064	30		14
47	45	9.684830	10.315170	9.742783	10.257217	10.057953	9.942047	15		13
48	57	9.684887	10.315113	9.742858	10.257142	10.057971	9.942029		3	12
49	15	9.684944	10.315056	9.742932	10.257068	10.057988	9.942012	45		11
50	30	9.685001	10.314999	9.743007	10.256993	10.058006	9.941994	30		10
51	45	9.685058	10.314942	9.743081	10.256919	10.058023	9.941977	15		9
52	58	9.685115	10.314885	9.743156	10.256844	10.058041	9.941959		2	8
53	15	9.685172	10.314828	9.743230	10.256770	10.058058	9.941942	45		7
54	30	9.685229	10.314771	9.743305	10.256695	10.058076	9.941924	30		6
55	45	9.685286	10.314714	9.743379	10.256621	10.058093	9.941907	15		5
56	59	9.685343	10.314657	9.743454	10.256546	10.058111	9.941889		1	4
57	15	9.685400	10.314600	9.743528	10.256472	10.058128	9.941872	45		3
58	30	9.685457	10.314543	9.743603	10.256397	10.058146	9.941854	30		2
59	45	9.685514	10.314486	9.743677	10.256323	10.058163	9.941837	15		1
60	60	9.685571	10.314429	9.743752	10.256248	10.058181	9.941819		0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
4° 4m.		LOG. SINES, &c.						61 deg.		

1 ^h 56 ^m .			LOG. SINES, &c. (t.)					29 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	0	9.685571	10.314429	9.743752	10.256248	10.058181	9.941819	60		60
1	15	9.685628	10.314372	9.743826	10.256174	10.058198	9.941802	45		59
2	30	9.685685	10.314315	9.743901	10.256099	10.058216	9.941784	30		58
3	45	9.685742	10.314258	9.743975	10.256025	10.058233	9.941767	15		57
4	1	9.685799	10.314201	9.744050	10.255950	10.058251	9.941749		59	56
5	15	9.685856	10.314144	9.744124	10.255876	10.058268	9.941732	45		55
6	30	9.685913	10.314087	9.744199	10.255801	10.058286	9.941714	30		54
7	45	9.685970	10.314030	9.744273	10.255727	10.058303	9.941697	15		53
8	2	9.686027	10.313973	9.744348	10.255652	10.058321	9.941679		58	52
9	15	9.686084	10.313916	9.744422	10.255578	10.058338	9.941662	45		51
10	30	9.686140	10.313860	9.744496	10.255504	10.058356	9.941645	30		50
11	45	9.686197	10.313803	9.744571	10.255429	10.058374	9.941626	15		49
12	3	9.686254	10.313746	9.744645	10.255355	10.058391	9.941609		57	48
13	15	9.686311	10.313689	9.744720	10.255280	10.058409	9.941591	45		47
14	30	9.686368	10.313632	9.744794	10.255206	10.058426	9.941574	30		46
15	45	9.686425	10.313575	9.744868	10.255132	10.058444	9.941556	15		45
16	4	9.686482	10.313518	9.744943	10.255057	10.058461	9.941539		56	44
17	15	9.686538	10.313462	9.745017	10.254983	10.058479	9.941521	45		43
18	30	9.686595	10.313405	9.745092	10.254908	10.058496	9.941504	30		42
19	45	9.686652	10.313348	9.745166	10.254834	10.058514	9.941486	15		41
20	5	9.686709	10.313291	9.745240	10.254760	10.058532	9.941468		55	40
21	15	9.686766	10.313234	9.745315	10.254685	10.058549	9.941451	45		39
22	30	9.686822	10.313178	9.745389	10.254611	10.058567	9.941433	30		38
23	45	9.686879	10.313121	9.745463	10.254537	10.058584	9.941416	15		37
24	6	9.686936	10.313064	9.745538	10.254462	10.058602	9.941398		54	36
25	15	9.686993	10.313007	9.745612	10.254388	10.058619	9.941381	45		35
26	30	9.687049	10.312951	9.745686	10.254314	10.058637	9.941363	30		34
27	45	9.687106	10.312894	9.745761	10.254239	10.058655	9.941345	15		33
28	7	9.687163	10.312837	9.745835	10.254165	10.058672	9.941328		53	32
29	15	9.687219	10.312781	9.745909	10.254091	10.058690	9.941310	45		31
30	30	9.687276	10.312724	9.745983	10.254017	10.058707	9.941293	30		30
31	45	9.687333	10.312667	9.746058	10.253942	10.058725	9.941275	15		29
32	8	9.687389	10.312611	9.746132	10.253868	10.058743	9.941257		52	28
33	15	9.687446	10.312554	9.746206	10.253794	10.058760	9.941240	45		27
34	30	9.687503	10.312497	9.746280	10.253720	10.058778	9.941222	30		26
35	45	9.687559	10.312441	9.746355	10.253645	10.058795	9.941205	15		25
36	9	9.687616	10.312384	9.746429	10.253571	10.058813	9.941187		51	24
37	15	9.687673	10.312327	9.746503	10.253497	10.058831	9.941169	45		23
38	30	9.687729	10.312271	9.746577	10.253423	10.058848	9.941152	30		22
39	45	9.687786	10.312214	9.746652	10.253348	10.058866	9.941134	15		21
40	10	9.687842	10.312158	9.746726	10.253274	10.058883	9.941117		50	20
41	15	9.687899	10.312101	9.746800	10.253200	10.058901	9.941099	45		19
42	30	9.687956	10.312044	9.746874	10.253126	10.058919	9.941081	30		18
43	45	9.688012	10.311988	9.746948	10.253052	10.058936	9.941064	15		17
44	11	9.688069	10.311931	9.747023	10.252977	10.058954	9.941046		49	16
45	15	9.688125	10.311875	9.747097	10.252903	10.058972	9.941028	45		15
46	30	9.688182	10.311818	9.747171	10.252829	10.058989	9.941011	30		14
47	45	9.688238	10.311762	9.747245	10.252755	10.059007	9.940993	15		13
48	12	9.688295	10.311705	9.747319	10.252681	10.059025	9.940975		48	12
49	15	9.688351	10.311649	9.747394	10.252606	10.059042	9.940958	45		11
50	30	9.688408	10.311592	9.747468	10.252532	10.059060	9.940940	30		10
51	45	9.688464	10.311536	9.747542	10.252458	10.059078	9.940922	15		9
52	13	9.688521	10.311479	9.747616	10.252384	10.059095	9.940905		47	8
53	15	9.688577	10.311423	9.747690	10.252310	10.059113	9.940887	45		7
54	30	9.688634	10.311366	9.747764	10.252236	10.059131	9.940869	30		6
55	45	9.688690	10.311310	9.747838	10.252162	10.059148	9.940852	15		5
56	14	9.688747	10.311253	9.747912	10.252088	10.059166	9.940834		46	4
57	15	9.688803	10.311197	9.747987	10.252013	10.059184	9.940816	45		3
58	30	9.688859	10.311141	9.748061	10.251939	10.059201	9.940799	30		2
59	45	9.688916	10.311084	9.748135	10.251865	10.059219	9.940781	15		1
60	15	9.688972	10.311028	9.748209	10.251791	10.059237	9.940763		45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
4 ^h 3 ^m .			LOG. SINES, &c.					60 deg.		

1 ^h 57 ^m .		LOG. SINES, &c. (t.)						29 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	15	9.688972	10.311028	9.748209	10.251791	10.059237	9.940763	45		60
1	15	9.689029	10.310971	9.748283	10.251717	10.059254	9.940746	45		59
2	30	9.689085	10.310915	9.748357	10.251643	10.059272	9.940728	30		58
3	45	9.689141	10.310859	9.748431	10.251569	10.059290	9.940710	15		57
4	16	9.689198	10.310802	9.748505	10.251495	10.059307	9.940693	44		56
5	15	9.689254	10.310746	9.748579	10.251421	10.059325	9.940675	45		55
6	30	9.689310	10.310690	9.748653	10.251347	10.059343	9.940657	30		54
7	45	9.689367	10.310633	9.748727	10.251273	10.059360	9.940640	15		53
8	17	9.689423	10.310577	9.748801	10.251199	10.059378	9.940622	43		52
9	15	9.689479	10.310521	9.748875	10.251125	10.059396	9.940604	45		51
10	30	9.689536	10.310464	9.748949	10.251051	10.059414	9.940586	30		50
11	45	9.689592	10.310408	9.749023	10.250977	10.059431	9.940569	15		49
12	18	9.689648	10.310352	9.749097	10.250903	10.059449	9.940551	42		48
13	15	9.689705	10.310295	9.749171	10.250829	10.059467	9.940533	45		47
14	30	9.689761	10.310239	9.749245	10.250755	10.059485	9.940515	30		46
15	45	9.689817	10.310183	9.749319	10.250681	10.059502	9.940498	15		45
16	19	9.689873	10.310127	9.749393	10.250607	10.059520	9.940480	41		44
17	15	9.689930	10.310070	9.749467	10.250533	10.059538	9.940462	45		43
18	30	9.689986	10.310014	9.749541	10.250459	10.059555	9.940445	30		42
19	45	9.690042	10.309958	9.749615	10.250385	10.059573	9.940427	15		41
20	20	9.690098	10.309902	9.749689	10.250311	10.059591	9.940409	40		40
21	15	9.690154	10.309846	9.749763	10.250237	10.059609	9.940391	45		39
22	30	9.690211	10.309789	9.749837	10.250163	10.059626	9.940374	30		38
23	45	9.690267	10.309733	9.749911	10.250089	10.059644	9.940356	15		37
24	21	9.690323	10.309677	9.749985	10.250015	10.059662	9.940338	39		36
25	15	9.690379	10.309621	9.750059	10.249941	10.059680	9.940320	45		35
26	30	9.690435	10.309565	9.750133	10.249867	10.059697	9.940303	30		34
27	45	9.690491	10.309509	9.750207	10.249793	10.059715	9.940285	15		33
28	22	9.690548	10.309452	9.750281	10.249719	10.059733	9.940267	38		32
29	15	9.690604	10.309396	9.750354	10.249646	10.059751	9.940249	45		31
30	30	9.690660	10.309340	9.750428	10.249572	10.059769	9.940231	30		30
31	45	9.690716	10.309284	9.750502	10.249498	10.059786	9.940214	15		29
32	23	9.690772	10.309228	9.750576	10.249424	10.059804	9.940196	37		28
33	15	9.690828	10.309172	9.750650	10.249350	10.059822	9.940178	45		27
34	30	9.690884	10.309116	9.750724	10.249276	10.059840	9.940160	30		26
35	45	9.690940	10.309060	9.750798	10.249202	10.059858	9.940142	15		25
36	24	9.690996	10.309004	9.750872	10.249128	10.059875	9.940125	36		24
37	15	9.691052	10.308948	9.750945	10.249055	10.059893	9.940107	45		23
38	30	9.691108	10.308892	9.751019	10.248981	10.059911	9.940089	30		22
39	45	9.691164	10.308836	9.751093	10.248907	10.059929	9.940071	15		21
40	25	9.691220	10.308780	9.751167	10.248833	10.059947	9.940053	35		20
41	15	9.691276	10.308724	9.751241	10.248759	10.059964	9.940036	45		19
42	30	9.691332	10.308668	9.751315	10.248685	10.059982	9.940018	30		18
43	45	9.691388	10.308612	9.751388	10.248612	10.060000	9.940000	15		17
44	26	9.691444	10.308556	9.751462	10.248538	10.060018	9.939982	34		16
45	15	9.691500	10.308500	9.751536	10.248464	10.060036	9.939964	45		15
46	30	9.691556	10.308444	9.751610	10.248390	10.060053	9.939947	30		14
47	45	9.691612	10.308388	9.751683	10.248317	10.060071	9.939929	15		13
48	27	9.691668	10.308332	9.751757	10.248243	10.060089	9.939911	33		12
49	15	9.691724	10.308276	9.751831	10.248169	10.060107	9.939893	45		11
50	30	9.691780	10.308220	9.751905	10.248095	10.060125	9.939875	30		10
51	45	9.691836	10.308164	9.751979	10.248021	10.060143	9.939857	15		9
52	28	9.691892	10.308108	9.752052	10.247948	10.060160	9.939840	32		8
53	15	9.691948	10.308052	9.752126	10.247874	10.060178	9.939822	45		7
54	30	9.692004	10.307996	9.752200	10.247800	10.060196	9.939804	30		6
55	45	9.692060	10.307940	9.752273	10.247727	10.060214	9.939786	15		5
56	29	9.692115	10.307885	9.752347	10.247653	10.060232	9.939768	31		4
57	15	9.692171	10.307829	9.752421	10.247579	10.060250	9.939750	45		3
58	30	9.692227	10.307773	9.752495	10.247505	10.060268	9.939732	30		2
59	45	9.692283	10.307717	9.752568	10.247432	10.060285	9.939715	15		1
60	30	9.692339	10.307661	9.752642	10.247358	10.060303	9.939697	30		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
4 ^h 2 ^m .		LOG. SINES, &c.						60 deg		

1 ^h 58 ^m .		LOG. SINES, &c. (t.)						29 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.692339	10.307661	9.752642	10.247358	10.060303	9.939697	30	60
1	15	9.692395	10.307605	9.752716	10.247284	10.060321	9.939679	45	59
2	30	9.692450	10.307550	9.752789	10.247211	10.060339	9.939661	30	58
3	45	9.692506	10.307494	9.752863	10.247137	10.060357	9.939643	15	57
4	31	9.692562	10.307438	9.752937	10.247063	10.060375	9.939625	29	56
5	15	9.692618	10.307382	9.753010	10.246990	10.060393	9.939607	45	55
6	30	9.692674	10.307326	9.753084	10.246916	10.060411	9.939589	30	54
7	45	9.692729	10.307271	9.753158	10.246842	10.060428	9.939572	15	53
8	32	9.692785	10.307215	9.753231	10.246769	10.060446	9.939554	28	52
9	15	9.692841	10.307159	9.753305	10.246695	10.060464	9.939536	45	51
10	30	9.692897	10.307103	9.753379	10.246621	10.060482	9.939518	30	50
11	45	9.692952	10.307048	9.753452	10.246548	10.060500	9.939500	15	49
12	33	9.693008	10.306992	9.753526	10.246474	10.060518	9.939482	27	48
13	15	9.693064	10.306936	9.753599	10.246401	10.060536	9.939464	45	47
14	30	9.693119	10.306881	9.753673	10.246327	10.060554	9.939446	30	46
15	45	9.693175	10.306825	9.753747	10.246253	10.060572	9.939428	15	45
16	34	9.693231	10.306769	9.753820	10.246180	10.060590	9.939410	26	44
17	15	9.693286	10.306714	9.753894	10.246106	10.060607	9.939393	45	43
18	30	9.693342	10.306658	9.753967	10.246033	10.060625	9.939375	30	42
19	45	9.693398	10.306602	9.754041	10.245959	10.060643	9.939357	15	41
20	35	9.693453	10.306547	9.754115	10.245885	10.060661	9.939339	25	40
21	15	9.693509	10.306491	9.754188	10.245812	10.060679	9.939321	45	39
22	30	9.693565	10.306435	9.754262	10.245738	10.060697	9.939303	30	38
23	45	9.693620	10.306380	9.754335	10.245665	10.060715	9.939285	15	37
24	36	9.693676	10.306324	9.754409	10.245591	10.060733	9.939267	24	36
25	15	9.693731	10.306269	9.754482	10.245518	10.060751	9.939249	45	35
26	30	9.693787	10.306213	9.754556	10.245444	10.060769	9.939231	30	34
27	45	9.693843	10.306157	9.754629	10.245371	10.060787	9.939213	15	33
28	37	9.693898	10.306102	9.754703	10.245297	10.060805	9.939195	23	32
29	15	9.693954	10.306046	9.754776	10.245224	10.060823	9.939177	45	31
30	30	9.694009	10.305991	9.754850	10.245150	10.060841	9.939159	30	30
31	45	9.694065	10.305935	9.754923	10.245077	10.060859	9.939141	15	29
32	38	9.694120	10.305880	9.754997	10.245003	10.060877	9.939123	22	28
33	15	9.694176	10.305824	9.755070	10.244930	10.060895	9.939105	45	27
34	30	9.694231	10.305769	9.755144	10.244856	10.060913	9.939087	30	26
35	45	9.694287	10.305713	9.755217	10.244783	10.060931	9.939069	15	25
36	39	9.694342	10.305658	9.755291	10.244709	10.060949	9.939051	21	24
37	15	9.694398	10.305602	9.755364	10.244636	10.060966	9.939034	45	23
38	30	9.694453	10.305547	9.755438	10.244562	10.060984	9.939016	30	22
39	45	9.694509	10.305491	9.755511	10.244489	10.061002	9.938998	15	21
40	40	9.694564	10.305436	9.755585	10.244415	10.061020	9.938980	20	20
41	15	9.694620	10.305380	9.755658	10.244342	10.061038	9.938962	45	19
42	30	9.694675	10.305325	9.755731	10.244269	10.061056	9.938944	30	18
43	45	9.694730	10.305270	9.755805	10.244195	10.061074	9.938926	15	17
44	41	9.694786	10.305214	9.755878	10.244122	10.061092	9.938908	19	16
45	15	9.694841	10.305159	9.755952	10.244048	10.061110	9.938890	45	15
46	30	9.694897	10.305103	9.756025	10.243975	10.061128	9.938872	30	14
47	45	9.694952	10.305048	9.756098	10.243902	10.061146	9.938854	15	13
48	42	9.695007	10.304993	9.756172	10.243828	10.061164	9.938836	18	12
49	15	9.695063	10.304937	9.756245	10.243755	10.061182	9.938818	45	11
50	30	9.695118	10.304882	9.756319	10.243681	10.061201	9.938799	30	10
51	45	9.695173	10.304827	9.756392	10.243608	10.061219	9.938781	15	9
52	43	9.695229	10.304771	9.756465	10.243535	10.061237	9.938763	17	8
53	15	9.695284	10.304716	9.756539	10.243461	10.061255	9.938745	45	7
54	30	9.695339	10.304661	9.756612	10.243388	10.061273	9.938727	30	6
55	45	9.695395	10.304605	9.756685	10.243315	10.061291	9.938709	15	5
56	44	9.695450	10.304550	9.756759	10.243241	10.061309	9.938691	16	4
57	15	9.695505	10.304495	9.756832	10.243168	10.061327	9.938673	45	3
58	30	9.695561	10.304439	9.756905	10.243095	10.061345	9.938655	30	2
59	45	9.695616	10.304384	9.756979	10.243021	10.061363	9.938637	15	1
60	45	9.695671	10.304329	9.757052	10.242948	10.061381	9.938619	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
4 ^h 1 ^m .		LOG. SINES, &c.						60 deg.	

1 ^h 59m.		LOG. SINES, &c. (t.)						29 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine	"	sec.
0	45	9.695671	10.304329	9.757052	10.242948	10.061381	9.938619	15	60
1	15	9.695726	10.304274	9.757125	10.242875	10.061399	9.938601	45	59
2	30	9.695782	10.304218	9.757199	10.242801	10.061417	9.938583	30	58
3	45	9.695837	10.304163	9.757272	10.242728	10.061435	9.938565	15	57
4	46	9.695892	10.304108	9.757345	10.242655	10.061453	9.938547	14	56
5	15	9.695947	10.304053	9.757418	10.242582	10.061471	9.938529	45	55
6	30	9.696003	10.303997	9.757492	10.242508	10.061489	9.938511	30	54
7	45	9.696058	10.303942	9.757565	10.242435	10.061507	9.938493	15	53
8	47	9.696113	10.303887	9.757638	10.242362	10.061525	9.938475	13	52
9	15	9.696168	10.303832	9.757711	10.242289	10.061543	9.938457	45	51
10	30	9.696223	10.303777	9.757785	10.242215	10.061562	9.938438	30	50
11	45	9.696278	10.303722	9.757858	10.242142	10.061580	9.938420	15	49
12	48	9.696334	10.303666	9.757931	10.242069	10.061598	9.938402	12	46
13	15	9.696389	10.303611	9.758004	10.241996	10.061616	9.938384	45	47
14	30	9.696444	10.303556	9.758078	10.241922	10.061634	9.938366	30	46
15	45	9.696499	10.303501	9.758151	10.241849	10.061652	9.938348	15	45
16	49	9.696554	10.303446	9.758224	10.241776	10.061670	9.938330	11	44
17	15	9.696609	10.303391	9.758297	10.241703	10.061688	9.938312	45	43
18	30	9.696664	10.303336	9.758371	10.241629	10.061706	9.938294	30	42
19	45	9.696719	10.303281	9.758444	10.241556	10.061724	9.938276	15	41
20	50	9.696774	10.303226	9.758517	10.241483	10.061742	9.938258	10	40
21	15	9.696830	10.303170	9.758590	10.241410	10.061761	9.938239	45	39
22	30	9.696885	10.303115	9.758663	10.241337	10.061779	9.938221	30	38
23	45	9.696940	10.303060	9.758736	10.241264	10.061797	9.938203	15	37
24	51	9.696995	10.303005	9.758810	10.241190	10.061815	9.938185	9	36
25	15	9.697050	10.302950	9.758883	10.241117	10.061833	9.938167	45	35
26	30	9.697105	10.302895	9.758956	10.241044	10.061851	9.938149	30	34
27	45	9.697160	10.302840	9.759029	10.240971	10.061869	9.938131	15	33
28	52	9.697215	10.302785	9.759102	10.240898	10.061887	9.938113	8	32
29	15	9.697270	10.302730	9.759175	10.240825	10.061906	9.938094	45	31
30	30	9.697325	10.302675	9.759248	10.240752	10.061924	9.938076	30	30
31	45	9.697380	10.302620	9.759322	10.240678	10.061942	9.938058	15	29
32	53	9.697435	10.302565	9.759395	10.240605	10.061960	9.938040	7	28
33	15	9.697490	10.302510	9.759468	10.240532	10.061978	9.938022	45	27
34	30	9.697545	10.302455	9.759541	10.240459	10.061996	9.938004	30	26
35	45	9.697600	10.302400	9.759614	10.240386	10.062015	9.937985	15	25
36	54	9.697654	10.302346	9.759687	10.240313	10.062033	9.937967	6	24
37	15	9.697709	10.302291	9.759760	10.240240	10.062051	9.937949	45	23
38	30	9.697764	10.302236	9.759833	10.240167	10.062069	9.937931	30	22
39	45	9.697819	10.302181	9.759906	10.240094	10.062087	9.937913	15	21
40	55	9.697874	10.302126	9.759979	10.240021	10.062105	9.937895	5	20
41	15	9.697929	10.302071	9.760052	10.239948	10.062124	9.937876	45	19
42	30	9.697984	10.302016	9.760125	10.239875	10.062142	9.937858	30	18
43	45	9.698039	10.301961	9.760199	10.239801	10.062160	9.937840	15	17
44	56	9.698094	10.301906	9.760272	10.239728	10.062178	9.937822	4	16
45	15	9.698148	10.301852	9.760345	10.239655	10.062196	9.937804	45	15
46	30	9.698203	10.301797	9.760418	10.239582	10.062214	9.937786	30	14
47	45	9.698258	10.301742	9.760491	10.239509	10.062233	9.937767	15	13
48	57	9.698313	10.301687	9.760564	10.239436	10.062251	9.937749	3	12
49	15	9.698368	10.301632	9.760637	10.239363	10.062269	9.937731	45	11
50	30	9.698422	10.301578	9.760710	10.239290	10.062287	9.937713	30	10
51	45	9.698477	10.301523	9.760783	10.239217	10.062305	9.937695	15	9
52	58	9.698532	10.301468	9.760856	10.239144	10.062324	9.937676	2	8
53	15	9.698587	10.301413	9.760929	10.239071	10.062342	9.937658	45	7
54	30	9.698642	10.301358	9.761002	10.238998	10.062360	9.937640	30	6
55	45	9.698696	10.301304	9.761075	10.238925	10.062378	9.937622	15	5
56	59	9.698751	10.301249	9.761148	10.238852	10.062397	9.937603	1	4
57	15	9.698806	10.301194	9.761220	10.238780	10.062415	9.937585	45	3
58	30	9.698861	10.301139	9.761293	10.238707	10.062433	9.937567	30	2
59	45	9.698915	10.301085	9.761366	10.238634	10.062451	9.937549	15	1
60	60	9.698970	10.301030	9.761439	10.238561	10.062469	9.937531	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
4 ^h 0 ^m .		LOG. SINES, &c.						60 deg.	

2 ^h 0 ^m .		LOG. SINES, &c. (t.)						30 deg.	
sec.	"	sine.	co-secant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.698970	10.301030	9.761439	10.238561	10.062469	9.937531	60	60
1	15	9.699025	10.300975	9.761512	10.238488	10.062488	9.937512	45	59
2	30	9.699079	10.300921	9.761585	10.238415	10.062506	9.937494	30	58
3	45	9.699134	10.300866	9.761658	10.238342	10.062524	9.937476	15	57
4	1	9.699189	10.300811	9.761731	10.238269	10.062542	9.937458	59	56
5	15	9.699243	10.300757	9.761804	10.238196	10.062561	9.937439	45	55
6	30	9.699298	10.300702	9.761877	10.238123	10.062579	9.937421	30	54
7	45	9.699353	10.300647	9.761950	10.238050	10.062597	9.937403	15	53
8	2	9.699407	10.300593	9.762023	10.237977	10.062615	9.937385	58	52
9	15	9.699462	10.300538	9.762096	10.237904	10.062634	9.937366	45	51
10	30	9.699517	10.300483	9.762168	10.237832	10.062652	9.937348	30	50
11	45	9.699571	10.300429	9.762241	10.237759	10.062670	9.937330	15	49
12	3	9.699626	10.300374	9.762314	10.237686	10.062688	9.937312	57	48
13	15	9.699680	10.300320	9.762387	10.237613	10.062707	9.937293	45	47
14	30	9.699735	10.300265	9.762460	10.237540	10.062725	9.937275	30	46
15	45	9.699789	10.300211	9.762533	10.237467	10.062743	9.937257	15	45
16	4	9.699844	10.300156	9.762606	10.237394	10.062762	9.937238	56	44
17	15	9.699899	10.300101	9.762678	10.237322	10.062780	9.937220	45	43
18	30	9.699953	10.300047	9.762751	10.237249	10.062798	9.937202	30	42
19	45	9.700008	10.299992	9.762824	10.237176	10.062816	9.937184	15	41
20	5	9.700062	10.299938	9.762897	10.237103	10.062835	9.937165	55	40
21	15	9.700117	10.299883	9.762970	10.237030	10.062853	9.937147	45	39
22	30	9.700171	10.299829	9.763042	10.236958	10.062871	9.937129	30	38
23	45	9.700226	10.299774	9.763115	10.236885	10.062890	9.937110	15	37
24	6	9.700280	10.299720	9.763188	10.236812	10.062908	9.937092	54	36
25	15	9.700335	10.299665	9.763261	10.236739	10.062926	9.937074	45	35
26	30	9.700389	10.299611	9.763334	10.236666	10.062945	9.937055	30	34
27	45	9.700444	10.299556	9.763406	10.236594	10.062963	9.937037	15	33
28	7	9.700498	10.299502	9.763479	10.236521	10.062981	9.937019	53	32
29	15	9.700552	10.299448	9.763552	10.236448	10.063000	9.937000	45	31
30	30	9.700607	10.299393	9.763625	10.236375	10.063018	9.936982	30	30
31	45	9.700661	10.299339	9.763697	10.236303	10.063036	9.936964	15	29
32	8	9.700716	10.299284	9.763770	10.236230	10.063054	9.936946	52	28
33	15	9.700770	10.299230	9.763843	10.236157	10.063073	9.936927	45	27
34	30	9.700825	10.299175	9.763916	10.236084	10.063091	9.936909	30	26
35	45	9.700879	10.299121	9.763988	10.236012	10.063109	9.936891	15	25
36	9	9.700933	10.299067	9.764061	10.235939	10.063128	9.936872	51	24
37	15	9.700988	10.299012	9.764134	10.235866	10.063146	9.936854	45	23
38	30	9.701042	10.298958	9.764207	10.235793	10.063165	9.936835	30	22
39	45	9.701096	10.298904	9.764279	10.235721	10.063183	9.936817	15	21
40	10	9.701151	10.298849	9.764352	10.235648	10.063201	9.936799	50	20
41	15	9.701205	10.298795	9.764425	10.235575	10.063220	9.936780	45	19
42	30	9.701259	10.298741	9.764497	10.235503	10.063238	9.936762	30	18
43	45	9.701314	10.298686	9.764570	10.235430	10.063256	9.936744	15	17
44	11	9.701368	10.298632	9.764643	10.235357	10.063275	9.936725	49	16
45	15	9.701422	10.298578	9.764715	10.235285	10.063293	9.936707	45	15
46	30	9.701477	10.298523	9.764788	10.235212	10.063311	9.936689	30	14
47	45	9.701531	10.298469	9.764861	10.235139	10.063330	9.936670	15	13
48	12	9.701585	10.298415	9.764933	10.235067	10.063348	9.936652	48	12
49	15	9.701639	10.298361	9.765006	10.234994	10.063367	9.936633	45	11
50	30	9.701694	10.298306	9.765079	10.234921	10.063385	9.936615	30	10
51	45	9.701748	10.298252	9.765151	10.234849	10.063403	9.936597	15	9
52	13	9.701802	10.298198	9.765224	10.234776	10.063422	9.936578	47	8
53	15	9.701856	10.298144	9.765296	10.234704	10.063440	9.936560	45	7
54	30	9.701911	10.298089	9.765369	10.234631	10.063459	9.936541	30	6
55	45	9.701965	10.298035	9.765442	10.234558	10.063477	9.936523	15	5
56	14	9.702019	10.297981	9.765514	10.234486	10.063495	9.936505	46	4
57	15	9.702073	10.297927	9.765587	10.234413	10.063514	9.936486	45	3
58	30	9.702127	10.297873	9.765659	10.234341	10.063532	9.936468	30	2
59	45	9.702182	10.297818	9.765732	10.234268	10.063551	9.936449	15	1
60	15	9.702236	10.297764	9.765805	10.234195	10.063569	9.936431	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 59 ^m .		LOG. SINES, &c.						59 deg.	

2 ^h 1 ^m .		LOG. SINES, &c. (t.)						30 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
9	15	9.702236	10.297764	9.765895	10.234195	10.063569	9.936431	45	60
1	15	9.702290	10.297710	9.765877	10.234123	10.063587	9.936413	45	59
2	30	9.702344	10.297656	9.765950	10.234050	10.063606	9.936394	30	58
3	45	9.702398	10.297602	9.766022	10.233978	10.063624	9.936376	15	57
4	16	9.702452	10.297548	9.766095	10.233905	10.063643	9.936357	44	56
5	15	9.702506	10.297494	9.766167	10.233833	10.063661	9.936339	45	55
6	30	9.702560	10.297440	9.766240	10.233760	10.063680	9.936320	30	54
7	45	9.702615	10.297385	9.766313	10.233687	10.063698	9.936302	15	53
8	17	9.702669	10.297331	9.766385	10.233615	10.063716	9.936284	43	52
9	15	9.702723	10.297277	9.766458	10.233542	10.063735	9.936265	45	51
10	30	9.702777	10.297223	9.766530	10.233470	10.063753	9.936247	30	50
11	45	9.702831	10.297169	9.766603	10.233397	10.063772	9.936228	15	49
12	18	9.702885	10.297115	9.766675	10.233325	10.063790	9.936210	42	48
13	15	9.702939	10.297061	9.766748	10.233252	10.063809	9.936191	45	47
14	30	9.702993	10.297007	9.766820	10.233180	10.063827	9.936173	30	46
15	45	9.703047	10.296953	9.766893	10.233107	10.063846	9.936154	15	45
16	19	9.703101	10.296899	9.766965	10.233035	10.063864	9.936136	41	44
17	15	9.703155	10.296845	9.767038	10.232962	10.063883	9.936117	45	43
18	30	9.703209	10.296791	9.767110	10.232890	10.063901	9.936099	30	42
19	45	9.703263	10.296737	9.767182	10.232818	10.063920	9.936080	15	41
20	20	9.703317	10.296683	9.767255	10.232745	10.063938	9.936062	40	40
21	15	9.703371	10.296629	9.767327	10.232673	10.063956	9.936044	45	39
22	30	9.703425	10.296575	9.767400	10.232600	10.063975	9.936025	30	38
23	45	9.703479	10.296521	9.767472	10.232528	10.063993	9.936007	15	37
24	21	9.703533	10.296467	9.767545	10.232455	10.064012	9.935988	39	36
25	15	9.703587	10.296413	9.767617	10.232383	10.064030	9.935970	45	35
26	30	9.703641	10.296359	9.767690	10.232310	10.064049	9.935951	30	34
27	45	9.703695	10.296305	9.767762	10.232238	10.064067	9.935933	15	33
28	22	9.703749	10.296251	9.767834	10.232166	10.064086	9.935914	38	32
29	15	9.703802	10.296198	9.767907	10.232093	10.064104	9.935896	45	31
30	30	9.703856	10.296144	9.767979	10.232021	10.064123	9.935877	30	30
31	45	9.703910	10.296090	9.768052	10.231948	10.064141	9.935859	15	29
32	23	9.703964	10.296036	9.768124	10.231876	10.064160	9.935840	37	28
33	15	9.704018	10.295982	9.768196	10.231804	10.064178	9.935822	45	27
34	30	9.704072	10.295928	9.768269	10.231731	10.064197	9.935803	30	26
35	45	9.704126	10.295874	9.768341	10.231659	10.064216	9.935784	15	25
36	24	9.704179	10.295821	9.768413	10.231587	10.064234	9.935766	36	24
37	15	9.704233	10.295767	9.768486	10.231514	10.064253	9.935747	45	23
38	30	9.704287	10.295713	9.768558	10.231442	10.064271	9.935729	30	22
39	45	9.704341	10.295659	9.768631	10.231369	10.064290	9.935710	15	21
40	25	9.704395	10.295605	9.768703	10.231297	10.064308	9.935692	35	20
41	15	9.704448	10.295552	9.768775	10.231225	10.064327	9.935673	45	19
42	30	9.704502	10.295498	9.768848	10.231152	10.064345	9.935655	30	18
43	45	9.704556	10.295444	9.768920	10.231080	10.064364	9.935636	15	17
44	26	9.704610	10.295390	9.768992	10.231008	10.064382	9.935618	34	16
45	15	9.704664	10.295336	9.769064	10.230936	10.064401	9.935599	45	15
46	30	9.704717	10.295283	9.769137	10.230863	10.064420	9.935580	30	14
47	45	9.704771	10.295229	9.769209	10.230791	10.064438	9.935562	15	13
48	27	9.704825	10.295175	9.769281	10.230719	10.064457	9.935543	33	12
49	15	9.704878	10.295122	9.769354	10.230646	10.064475	9.935525	45	11
50	30	9.704932	10.295068	9.769426	10.230574	10.064494	9.935506	30	10
51	45	9.704986	10.295014	9.769498	10.230502	10.064512	9.935488	15	9
52	28	9.705040	10.294960	9.769570	10.230430	10.064531	9.935469	32	8
53	15	9.705093	10.294907	9.769643	10.230357	10.064550	9.935450	45	7
54	30	9.705147	10.294853	9.769715	10.230285	10.064568	9.935432	30	6
55	45	9.705201	10.294799	9.769787	10.230213	10.064587	9.935413	15	5
56	29	9.705254	10.294746	9.769860	10.230140	10.064605	9.935395	31	4
57	15	9.705308	10.294692	9.769932	10.230068	10.064624	9.935376	45	3
58	30	9.705362	10.294638	9.770004	10.229996	10.064642	9.935358	30	2
59	45	9.705415	10.294585	9.770076	10.229924	10.064661	9.935339	15	1
60	30	9.705469	10.294531	9.770148	10.229852	10.064680	9.935320	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 58 .		LOG. SINES, &c.						59 deg.	

2 ^h 2 ^m .		LOG. SINES, &c. (t.)						30 deg.	
sec.	"	sine.	cossecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.705469	10.294531	9.770148	10.229852	10.064680	9.935320	30	60
1	15	9.705522	10.294478	9.770221	10.229779	10.064698	9.935302	45	59
2	30	9.705576	10.294424	9.770293	10.229707	10.064717	9.935283	30	58
3	45	9.705630	10.294370	9.770365	10.229635	10.064735	9.935265	15	57
4	31	9.705683	10.294317	9.770437	10.229563	10.064754	9.935246	29	56
5	15	9.705737	10.294263	9.770509	10.229491	10.064773	9.935227	45	55
6	30	9.705790	10.294210	9.770582	10.229418	10.064791	9.935209	30	54
7	45	9.705844	10.294156	9.770654	10.229346	10.064810	9.935190	15	53
8	32	9.705897	10.294103	9.770726	10.229274	10.064829	9.935171	28	52
9	15	9.705951	10.294049	9.770798	10.229202	10.064847	9.935153	45	51
10	30	9.706005	10.293995	9.770870	10.229130	10.064866	9.935134	30	50
11	45	9.706058	10.293942	9.770943	10.229057	10.064884	9.935116	15	49
12	33	9.706112	10.293888	9.771015	10.228985	10.064903	9.935097	27	48
13	15	9.706165	10.293835	9.771087	10.228913	10.064922	9.935078	45	47
14	30	9.706219	10.293781	9.771159	10.228841	10.064940	9.935060	30	46
15	45	9.706272	10.293728	9.771231	10.228769	10.064959	9.935041	15	45
16	34	9.706326	10.293674	9.771303	10.228697	10.064978	9.935022	26	44
17	15	9.706379	10.293621	9.771375	10.228625	10.064996	9.935004	45	43
18	30	9.706432	10.293568	9.771447	10.228553	10.065015	9.934985	30	42
19	45	9.706486	10.293514	9.771520	10.228480	10.065034	9.934966	15	41
20	35	9.706539	10.293461	9.771592	10.228408	10.065052	9.934948	25	40
21	15	9.706593	10.293407	9.771664	10.228336	10.065071	9.934929	45	39
22	30	9.706646	10.293354	9.771736	10.228264	10.065090	9.934910	30	38
23	45	9.706700	10.293300	9.771808	10.228192	10.065108	9.934892	15	37
24	36	9.706753	10.293247	9.771880	10.228120	10.065127	9.934873	24	36
25	15	9.706806	10.293194	9.771952	10.228048	10.065146	9.934854	45	35
26	30	9.706860	10.293140	9.772024	10.227976	10.065164	9.934836	30	34
27	45	9.706913	10.293087	9.772096	10.227904	10.065183	9.934817	15	33
28	37	9.706967	10.293033	9.772168	10.227832	10.065202	9.934798	23	32
29	15	9.707020	10.292980	9.772240	10.227760	10.065220	9.934780	45	31
30	30	9.707073	10.292927	9.772312	10.227688	10.065239	9.934761	30	30
31	45	9.707127	10.292873	9.772384	10.227616	10.065258	9.934742	15	29
32	38	9.707180	10.292820	9.772457	10.227543	10.065277	9.934723	22	28
33	15	9.707233	10.292767	9.772529	10.227471	10.065295	9.934705	45	27
34	30	9.707287	10.292713	9.772601	10.227399	10.065314	9.934686	30	26
35	45	9.707340	10.292660	9.772673	10.227327	10.065333	9.934667	15	25
36	39	9.707393	10.292607	9.772745	10.227255	10.065351	9.934649	21	24
37	15	9.707447	10.292553	9.772817	10.227183	10.065370	9.934630	45	23
38	30	9.707500	10.292500	9.772889	10.227111	10.065389	9.934611	30	22
39	45	9.707553	10.292447	9.772961	10.227039	10.065408	9.934592	15	21
40	40	9.707606	10.292394	9.773033	10.226967	10.065426	9.934574	20	20
41	15	9.707660	10.292340	9.773105	10.226895	10.065445	9.934555	45	19
42	30	9.707713	10.292287	9.773177	10.226823	10.065464	9.934536	30	18
43	45	9.707766	10.292234	9.773249	10.226751	10.065482	9.934518	15	17
44	41	9.707819	10.292181	9.773321	10.226679	10.065501	9.934499	19	16
45	15	9.707873	10.292127	9.773393	10.226607	10.065520	9.934480	45	15
46	30	9.707926	10.292074	9.773464	10.226536	10.065539	9.934461	30	14
47	45	9.707979	10.292021	9.773536	10.226464	10.065557	9.934443	15	13
48	42	9.708032	10.291968	9.773608	10.226392	10.065576	9.934424	18	12
49	15	9.708085	10.291915	9.773680	10.226320	10.065595	9.934405	45	11
50	30	9.708138	10.291861	9.773752	10.226248	10.065614	9.934386	30	10
51	45	9.708192	10.291808	9.773824	10.226176	10.065632	9.934368	15	9
52	43	9.708245	10.291755	9.773896	10.226104	10.065651	9.934349	17	8
53	15	9.708298	10.291702	9.773968	10.226032	10.065670	9.934330	45	7
54	30	9.708351	10.291649	9.774040	10.225960	10.065689	9.934311	30	6
55	45	9.708404	10.291596	9.774112	10.225888	10.065708	9.934292	15	5
56	44	9.708457	10.291543	9.774184	10.225816	10.065726	9.934274	16	4
57	15	9.708511	10.291489	9.774256	10.225744	10.065745	9.934255	45	3
58	30	9.708564	10.291436	9.774328	10.225672	10.065764	9.934236	30	2
59	45	9.708617	10.291383	9.774399	10.225601	10.065783	9.934217	15	1
60	45	9.708670	10.291330	9.774471	10.225529	10.065801	9.934199	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cossecant.	sine.	"	sec.
3 ^h 57 ^m .		LOG. SINES, &c.						59 deg.	

2 ^h 3 ^m .		LOG. SINES, &c. (t.)						30 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.708670	10.291330	9.774471	10.225529	10.065801	9.934199	15	60
1	15	9.708723	10.291277	9.774543	10.225457	10.065820	9.934180	45	59
2	30	9.708776	10.291224	9.774615	10.225385	10.065839	9.934161	30	58
3	45	9.708829	10.291171	9.774687	10.225313	10.065858	9.934142	15	57
4	46	9.708882	10.291118	9.774759	10.225241	10.065877	9.934123	14	56
5	15	9.708935	10.291065	9.774831	10.225169	10.065895	9.934105	45	55
6	30	9.708988	10.291012	9.774902	10.225098	10.065914	9.934086	30	54
7	45	9.709041	10.290959	9.774974	10.225026	10.065933	9.934067	15	53
8	47	9.709094	10.290906	9.775046	10.224954	10.065952	9.934048	13	52
9	15	9.709147	10.290853	9.775118	10.224882	10.065971	9.934029	45	51
10	30	9.709200	10.290800	9.775190	10.224810	10.065990	9.934010	30	50
11	45	9.709253	10.290747	9.775262	10.224738	10.066008	9.933992	15	49
12	48	9.709306	10.290694	9.775333	10.224667	10.066027	9.933973	12	48
13	15	9.709359	10.290641	9.775405	10.224595	10.066046	9.933954	45	47
14	30	9.709412	10.290588	9.775477	10.224523	10.066065	9.933935	30	46
15	45	9.709465	10.290535	9.775549	10.224451	10.066084	9.933916	15	45
16	49	9.709518	10.290482	9.775621	10.224379	10.066102	9.933898	11	44
17	15	9.709571	10.290429	9.775692	10.224308	10.066121	9.933879	45	43
18	30	9.709624	10.290376	9.775764	10.224236	10.066140	9.933860	30	42
19	45	9.709677	10.290323	9.775836	10.224164	10.066159	9.933841	15	41
20	50	9.709730	10.290270	9.775908	10.224092	10.066178	9.933822	10	40
21	15	9.709783	10.290217	9.775979	10.224021	10.066197	9.933803	45	39
22	30	9.709836	10.290164	9.776051	10.223949	10.066216	9.933784	30	38
23	45	9.709889	10.290111	9.776123	10.223877	10.066234	9.933766	15	37
24	51	9.709941	10.290059	9.776195	10.223805	10.066253	9.933747	9	36
25	15	9.709994	10.290006	9.776266	10.223734	10.066270	9.933730	45	35
26	30	9.710047	10.289953	9.776338	10.223662	10.066291	9.933709	30	34
27	45	9.710100	10.289900	9.776410	10.223590	10.066310	9.933690	15	33
28	52	9.710153	10.289847	9.776482	10.223518	10.066329	9.933671	8	32
29	15	9.710206	10.289794	9.776553	10.223447	10.066348	9.933652	45	31
30	30	9.710259	10.289741	9.776625	10.223375	10.066367	9.933633	30	30
31	45	9.710311	10.289689	9.776697	10.223303	10.066385	9.933615	15	29
32	53	9.710364	10.289636	9.776768	10.223232	10.066404	9.933596	7	28
33	15	9.710417	10.289583	9.776840	10.223160	10.066423	9.933577	45	27
34	30	9.710470	10.289530	9.776912	10.223088	10.066442	9.933558	30	26
35	45	9.710523	10.289477	9.776983	10.223017	10.066461	9.933539	15	25
36	54	9.710575	10.289425	9.777055	10.222945	10.066480	9.933520	6	24
37	15	9.710628	10.289372	9.777127	10.222873	10.066499	9.933501	45	23
38	30	9.710681	10.289319	9.777198	10.222802	10.066518	9.933482	30	22
39	45	9.710734	10.289266	9.777270	10.222730	10.066537	9.933463	15	21
40	55	9.710786	10.289214	9.777342	10.222658	10.066556	9.933444	5	20
41	15	9.710839	10.289161	9.777413	10.222587	10.066574	9.933426	45	19
42	30	9.710892	10.289108	9.777485	10.222515	10.066593	9.933407	30	18
43	45	9.710944	10.289056	9.777557	10.222443	10.066612	9.933388	15	17
44	56	9.710997	10.289003	9.777628	10.222372	10.066631	9.933369	4	16
45	15	9.711050	10.288950	9.777700	10.222300	10.066650	9.933350	45	15
46	30	9.711103	10.288897	9.777772	10.222228	10.066669	9.933331	30	14
47	45	9.711155	10.288845	9.777843	10.222157	10.066688	9.933312	15	13
48	57	9.711208	10.288792	9.777915	10.222085	10.066707	9.933293	3	12
49	15	9.711261	10.288739	9.777986	10.222014	10.066726	9.933274	45	11
50	30	9.711313	10.288687	9.778058	10.221942	10.066745	9.933255	30	10
51	45	9.711366	10.288634	9.778130	10.221870	10.066764	9.933236	15	9
52	58	9.711419	10.288581	9.778201	10.221799	10.066783	9.933217	2	8
53	15	9.711471	10.288529	9.778273	10.221727	10.066802	9.933198	45	7
54	30	9.711524	10.288476	9.778344	10.221656	10.066821	9.933179	30	6
55	45	9.711576	10.288424	9.778416	10.221584	10.066840	9.933160	15	5
56	59	9.711629	10.288371	9.778487	10.221513	10.066859	9.933141	1	4
57	15	9.711682	10.288318	9.778559	10.221441	10.066878	9.933122	45	3
58	30	9.711734	10.288266	9.778631	10.221369	10.066897	9.933103	30	2
59	45	9.711787	10.288213	9.778702	10.221298	10.066915	9.933085	15	1
60	60	9.711839	10.288161	9.778774	10.221226	10.066934	9.933066	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 56 ^m .		LOG. SINES, &c.						59 deg.	

2 ^h 4 ^m .			LOG. SINES, &c. (t.)					31 deg		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	0	9.711839	10.288161	9.778774	10.221226	10.066934	9.933066	60	60	
1	15	9.711892	10.288108	9.778845	10.221155	10.066953	9.933047	45	59	
2	30	9.711944	10.288056	9.778917	10.221083	10.066972	9.933028	30	58	
3	45	9.711997	10.288003	9.778988	10.221012	10.066991	9.933009	15	57	
4	1	9.712049	10.287951	9.779060	10.220940	10.067010	9.932990	59	56	
5	15	9.712102	10.287898	9.779131	10.220869	10.067029	9.932971	45	55	
6	30	9.712155	10.287845	9.779203	10.220797	10.067048	9.932952	30	54	
7	45	9.712207	10.287793	9.779274	10.220726	10.067067	9.932933	15	53	
8	2	9.712260	10.287740	9.779346	10.220654	10.067086	9.932914	58	52	
9	15	9.712312	10.287688	9.779417	10.220583	10.067105	9.932895	45	51	
10	30	9.712364	10.287636	9.779489	10.220511	10.067124	9.932876	30	50	
11	45	9.712417	10.287583	9.779560	10.220440	10.067143	9.932857	15	49	
12	3	9.712469	10.287531	9.779632	10.220368	10.067162	9.932838	57	48	
13	15	9.712522	10.287478	9.779703	10.220297	10.067181	9.932819	45	47	
14	30	9.712574	10.287426	9.779775	10.220225	10.067200	9.932800	30	46	
15	45	9.712627	10.287373	9.779846	10.220154	10.067219	9.932781	15	45	
16	4	9.712679	10.287321	9.779918	10.220082	10.067238	9.932762	56	44	
17	15	9.712732	10.287268	9.779989	10.220011	10.067258	9.932742	45	43	
18	30	9.712784	10.287216	9.780061	10.219939	10.067277	9.932723	30	42	
19	45	9.712836	10.287164	9.780132	10.219868	10.067296	9.932704	15	41	
20	5	9.712889	10.287111	9.780203	10.219797	10.067315	9.932685	55	40	
21	15	9.712941	10.287059	9.780275	10.219725	10.067334	9.932666	45	39	
22	30	9.712994	10.287006	9.780346	10.219654	10.067353	9.932647	30	38	
23	45	9.713046	10.286954	9.780418	10.219582	10.067372	9.932628	15	37	
24	6	9.713098	10.286902	9.780489	10.219511	10.067391	9.932609	54	36	
25	15	9.713151	10.286849	9.780560	10.219440	10.067410	9.932590	45	35	
26	30	9.713203	10.286797	9.780632	10.219368	10.067429	9.932571	30	34	
27	45	9.713255	10.286745	9.780703	10.219297	10.067448	9.932552	15	33	
28	7	9.713308	10.286692	9.780775	10.219225	10.067467	9.932533	53	32	
29	15	9.713360	10.286640	9.780846	10.219154	10.067486	9.932514	45	31	
30	30	9.713412	10.286588	9.780917	10.219083	10.067505	9.932495	30	30	
31	45	9.713465	10.286535	9.780989	10.219011	10.067524	9.932476	15	29	
32	8	9.713517	10.286483	9.781060	10.218940	10.067543	9.932457	52	28	
33	15	9.713569	10.286431	9.781131	10.218869	10.067562	9.932438	45	27	
34	30	9.713621	10.286379	9.781203	10.218797	10.067581	9.932419	30	26	
35	45	9.713674	10.286326	9.781274	10.218726	10.067601	9.932399	15	25	
36	9	9.713726	10.286274	9.781346	10.218654	10.067620	9.932380	51	24	
37	15	9.713778	10.286222	9.781417	10.218583	10.067639	9.932361	45	23	
38	30	9.713830	10.286170	9.781488	10.218512	10.067658	9.932342	30	22	
39	45	9.713883	10.286117	9.781560	10.218440	10.067677	9.932323	15	21	
40	10	9.713935	10.286065	9.781631	10.218369	10.067696	9.932304	50	20	
41	15	9.713987	10.286013	9.781702	10.218298	10.067715	9.932285	45	19	
42	30	9.714039	10.285961	9.781773	10.218227	10.067734	9.932266	30	18	
43	45	9.714091	10.285909	9.781845	10.218155	10.067753	9.932247	15	17	
44	11	9.714144	10.285856	9.781916	10.218084	10.067772	9.932228	49	16	
45	15	9.714196	10.285804	9.781987	10.218013	10.067792	9.932208	45	15	
46	30	9.714248	10.285752	9.782059	10.217941	10.067811	9.932189	30	14	
47	45	9.714300	10.285700	9.782130	10.217870	10.067830	9.932170	15	13	
48	12	9.714352	10.285648	9.782201	10.217799	10.067849	9.932151	48	12	
49	15	9.714404	10.285596	9.782273	10.217727	10.067868	9.932132	45	11	
50	30	9.714457	10.285543	9.782344	10.217656	10.067887	9.932113	30	10	
51	45	9.714509	10.285491	9.782415	10.217585	10.067906	9.932094	15	9	
52	13	9.714561	10.285439	9.782486	10.217514	10.067925	9.932075	47	8	
53	15	9.714613	10.285387	9.782558	10.217442	10.067945	9.932056	45	7	
54	30	9.714665	10.285335	9.782629	10.217371	10.067964	9.932037	30	6	
55	45	9.714717	10.285283	9.782700	10.217300	10.067983	9.932017	15	5	
56	14	9.714769	10.285231	9.782771	10.217229	10.068002	9.931998	46	4	
57	15	9.714821	10.285179	9.782843	10.217157	10.068021	9.931979	45	3	
58	30	9.714873	10.285127	9.782914	10.217086	10.068040	9.931960	30	2	
59	45	9.714925	10.285075	9.782985	10.217015	10.068060	9.931940	15	1	
60	15	9.714978	10.285022	9.783056	10.216944	10.068079	9.931921	45	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
3 ^h 55 ^m .			LOG. SINES, &c.					58 deg		

2 ^h 5 ^m .		LOG. SINES, &c. (t.)						31 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	15	9.714978	10.285022	9.783056	10.216944	10.068079	9.931921	45		60
1	15	9.715030	10.284970	9.783127	10.216873	10.068093	9.931902	45		59
2	30	9.715082	10.284918	9.783199	10.216801	10.068117	9.931883	30		58
3	45	9.715134	10.284866	9.783270	10.216730	10.068136	9.931864	15		57
4	16	9.715186	10.284814	9.783341	10.216659	10.068155	9.931845	44		56
5	15	9.715238	10.284762	9.783412	10.216588	10.068175	9.931825	45		55
6	30	9.715290	10.284710	9.783483	10.216517	10.068194	9.931806	30		54
7	45	9.715342	10.284658	9.783555	10.216445	10.068213	9.931787	15		53
8	17	9.715394	10.284606	9.783626	10.216374	10.068232	9.931768	43		52
9	15	9.715446	10.284554	9.783697	10.216303	10.068251	9.931749	45		51
10	30	9.715498	10.284502	9.783768	10.216232	10.068271	9.931729	30		50
11	45	9.715550	10.284450	9.783839	10.216161	10.068290	9.931710	15		49
12	18	9.715601	10.284399	9.783910	10.216090	10.068309	9.931691	42		48
13	15	9.715653	10.284347	9.783981	10.216019	10.068328	9.931672	45		47
14	30	9.715705	10.284295	9.784053	10.215947	10.068347	9.931653	30		46
15	45	9.715757	10.284243	9.784124	10.215876	10.068367	9.931633	15		45
16	19	9.715809	10.284191	9.784195	10.215805	10.068386	9.931614	41		44
17	15	9.715861	10.284139	9.784266	10.215734	10.068405	9.931595	45		43
18	30	9.715913	10.284087	9.784337	10.215663	10.068424	9.931576	30		42
19	45	9.715965	10.284035	9.784408	10.215592	10.068443	9.931557	15		41
20	20	9.716017	10.283983	9.784479	10.215521	10.068463	9.931537	40		40
21	15	9.716069	10.283931	9.784550	10.215450	10.068482	9.931518	45		39
22	30	9.716120	10.283880	9.784622	10.215378	10.068501	9.931499	30		38
23	45	9.716172	10.283828	9.784693	10.215307	10.068520	9.931480	15		37
24	21	9.716224	10.283776	9.784764	10.215236	10.068540	9.931460	39		36
25	15	9.716276	10.283724	9.784835	10.215165	10.068559	9.931441	45		35
26	30	9.716328	10.283672	9.784906	10.215094	10.068578	9.931422	30		34
27	45	9.716380	10.283620	9.784977	10.215023	10.068597	9.931403	15		33
28	22	9.716432	10.283568	9.785048	10.214952	10.068617	9.931383	38		32
29	15	9.716483	10.283517	9.785119	10.214881	10.068636	9.931364	45		31
30	30	9.716535	10.283465	9.785190	10.214810	10.068655	9.931345	30		30
31	45	9.716587	10.283413	9.785261	10.214739	10.068674	9.931326	15		29
32	23	9.716639	10.283361	9.785332	10.214668	10.068694	9.931306	37		28
33	15	9.716690	10.283310	9.785403	10.214597	10.068713	9.931287	45		27
34	30	9.716742	10.283258	9.785474	10.214526	10.068732	9.931268	30		26
35	45	9.716794	10.283206	9.785545	10.214455	10.068751	9.931249	15		25
36	24	9.716846	10.283154	9.785616	10.214384	10.068771	9.931229	36		24
37	15	9.716897	10.283103	9.785687	10.214313	10.068790	9.931210	45		23
38	30	9.716949	10.283051	9.785758	10.214242	10.068809	9.931191	30		22
39	45	9.717001	10.282999	9.785829	10.214171	10.068829	9.931171	15		21
40	25	9.717053	10.282947	9.785900	10.214100	10.068848	9.931152	35		20
41	15	9.717104	10.282896	9.785971	10.214029	10.068867	9.931133	45		19
42	30	9.717156	10.282844	9.786042	10.213958	10.068886	9.931114	30		18
43	45	9.717208	10.282792	9.786113	10.213887	10.068906	9.931094	15		17
44	26	9.717259	10.282741	9.786184	10.213816	10.068925	9.931075	34		16
45	15	9.717311	10.282689	9.786255	10.213745	10.068944	9.931056	45		15
46	30	9.717363	10.282637	9.786326	10.213674	10.068964	9.931036	30		14
47	45	9.717414	10.282586	9.786397	10.213603	10.068983	9.931017	15		13
48	27	9.717466	10.282534	9.786468	10.213532	10.069002	9.930998	33		12
49	15	9.717518	10.282482	9.786539	10.213461	10.069022	9.930978	45		11
50	30	9.717569	10.282431	9.786610	10.213390	10.069041	9.930959	30		10
51	45	9.717621	10.282379	9.786681	10.213319	10.069060	9.930940	15		9
52	28	9.717672	10.282328	9.786752	10.213248	10.069080	9.930920	32		8
53	15	9.717724	10.282276	9.786823	10.213177	10.069099	9.930901	45		7
54	30	9.717776	10.282224	9.786894	10.213106	10.069118	9.930882	30		6
55	45	9.717827	10.282173	9.786965	10.213035	10.069138	9.930862	15		5
56	29	9.717879	10.282121	9.787036	10.212964	10.069157	9.930843	31		4
57	15	9.717930	10.282070	9.787107	10.212893	10.069176	9.930824	45		3
58	30	9.717982	10.282018	9.787177	10.212823	10.069196	9.930804	30		2
59	45	9.718034	10.281966	9.787248	10.212752	10.069215	9.930785	15		1
60	30	9.718085	10.281915	9.787319	10.212681	10.069234	9.930766	30		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
3 ^h 54 ^m .		LOG. SINES &c.						58 deg.		

2 ^h 6 ^m .		LOG. SINES, &c. (t.)						31 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.718085	10.281915	9.787319	10.212681	10.069234	9.930766	30	60
1	15	9.718137	10.281863	9.787390	10.212610	10.069254	9.930746	45	59
2	30	9.718188	10.281812	9.787461	10.212539	10.069273	9.930727	30	58
3	45	9.718240	10.281760	9.787532	10.212468	10.069292	9.930708	15	57
4	31	9.718291	10.281709	9.787603	10.212397	10.069312	9.930688	29	56
5	15	9.718343	10.281657	9.787674	10.212326	10.069331	9.930669	45	55
6	30	9.718394	10.281606	9.787745	10.212255	10.069350	9.930650	30	54
7	45	9.718446	10.281554	9.787815	10.212185	10.069370	9.930630	15	53
8	32	9.718497	10.281503	9.787886	10.212114	10.069389	9.930611	28	52
9	15	9.718549	10.281451	9.787957	10.212043	10.069409	9.930591	45	51
10	30	9.718600	10.281400	9.788028	10.211972	10.069428	9.930572	30	50
11	45	9.718651	10.281349	9.788099	10.211901	10.069447	9.930553	15	49
12	33	9.718703	10.281297	9.788170	10.211830	10.069467	9.930533	27	48
13	15	9.718754	10.281246	9.788241	10.211760	10.069486	9.930514	45	47
14	30	9.718806	10.281194	9.788311	10.211689	10.069506	9.930494	30	46
15	45	9.718857	10.281143	9.788382	10.211618	10.069525	9.930475	15	45
16	34	9.718909	10.281091	9.788453	10.211547	10.069544	9.930456	26	44
17	15	9.718960	10.281040	9.788524	10.211476	10.069564	9.930436	45	43
18	30	9.719011	10.280989	9.788594	10.211406	10.069583	9.930417	30	42
19	45	9.719063	10.280937	9.788665	10.211335	10.069603	9.930397	15	41
20	35	9.719114	10.280886	9.788736	10.211264	10.069622	9.930378	25	40
21	15	9.719166	10.280834	9.788807	10.211193	10.069641	9.930359	45	39
22	30	9.719217	10.280783	9.788878	10.211122	10.069661	9.930339	30	38
23	45	9.719268	10.280732	9.788948	10.211052	10.069680	9.930320	15	37
24	36	9.719320	10.280680	9.789019	10.210981	10.069700	9.930300	24	36
25	15	9.719371	10.280629	9.789090	10.210910	10.069719	9.930281	45	35
26	30	9.719422	10.280578	9.789161	10.210839	10.069739	9.930261	30	34
27	45	9.719474	10.280526	9.789231	10.210769	10.069758	9.930242	15	33
28	37	9.719525	10.280475	9.789302	10.210698	10.069777	9.930223	23	32
29	15	9.719576	10.280424	9.789373	10.210627	10.069797	9.930203	45	31
30	30	9.719627	10.280373	9.789444	10.210556	10.069816	9.930184	30	30
31	45	9.719679	10.280321	9.789514	10.210486	10.069836	9.930164	15	29
32	38	9.719730	10.280270	9.789585	10.210415	10.069855	9.930145	22	28
33	15	9.719781	10.280219	9.789656	10.210344	10.069875	9.930125	45	27
34	30	9.719833	10.280167	9.789727	10.210273	10.069894	9.930106	30	26
35	45	9.719884	10.280116	9.789797	10.210203	10.069914	9.930086	15	25
36	39	9.719935	10.280065	9.789868	10.210132	10.069933	9.930067	21	24
37	15	9.719986	10.280014	9.789939	10.210061	10.069953	9.930047	45	23
38	30	9.720037	10.279963	9.790009	10.209991	10.069972	9.930028	30	22
39	45	9.720089	10.279911	9.790080	10.209920	10.069991	9.930009	15	21
40	40	9.720140	10.279860	9.790151	10.209849	10.070011	9.929989	20	20
41	15	9.720191	10.279809	9.790221	10.209779	10.070030	9.929970	45	19
42	30	9.720242	10.279758	9.790292	10.209708	10.070050	9.929950	30	18
43	45	9.720293	10.279707	9.790363	10.209637	10.070069	9.929931	15	17
44	41	9.720345	10.279655	9.790433	10.209567	10.070089	9.929911	19	16
45	15	9.720396	10.279604	9.790504	10.209496	10.070108	9.929892	45	15
46	30	9.720447	10.279553	9.790575	10.209425	10.070128	9.929872	30	14
47	45	9.720498	10.279502	9.790645	10.209355	10.070147	9.929853	15	13
48	42	9.720549	10.279451	9.790716	10.209284	10.070167	9.929833	18	12
49	15	9.720600	10.279400	9.790787	10.209213	10.070186	9.929814	45	11
50	30	9.720651	10.279349	9.790857	10.209143	10.070206	9.929794	30	10
51	45	9.720703	10.279297	9.790928	10.209072	10.070225	9.929775	15	9
52	43	9.720754	10.279246	9.790999	10.209001	10.070245	9.929755	17	8
53	15	9.720805	10.279195	9.791069	10.208931	10.070264	9.929736	45	7
54	30	9.720856	10.279144	9.791140	10.208860	10.070284	9.929716	30	6
55	45	9.720907	10.279093	9.791210	10.208790	10.070304	9.929696	15	5
56	44	9.720958	10.279042	9.791281	10.208719	10.070323	9.929677	16	4
57	15	9.721009	10.278991	9.791352	10.208648	10.070343	9.929657	45	3
58	30	9.721060	10.278940	9.791422	10.208578	10.070362	9.929638	30	2
59	45	9.721111	10.278889	9.791493	10.208507	10.070382	9.929618	15	1
60	45	9.721162	10.278838	9.791563	10.208437	10.070401	9.929599	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 53 ^m .		LOG. SINES, &c.						58 deg.	

2 nd 7 ^m .		LOG. SINES, &c. (t.)				31 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.721162	10.278338	9.791563	10.208437	10.070401	9.929599	15	60
1	15	9.721213	10.278787	9.791634	10.208366	10.070421	9.929579	45	59
2	30	9.721264	10.278736	9.791705	10.208295	10.070440	9.929560	30	58
3	45	9.721315	10.278685	9.791775	10.208225	10.070460	9.929540	15	57
4	46	9.721366	10.278634	9.791846	10.208154	10.070479	9.929521	14	56
5	15	9.721417	10.278583	9.791916	10.208084	10.070499	9.929501	45	55
6	30	9.721468	10.278532	9.791987	10.208013	10.070519	9.929481	30	54
7	45	9.721519	10.278481	9.792057	10.207943	10.070538	9.929462	15	53
8	47	9.721570	10.278430	9.792128	10.207872	10.070558	9.929442	13	52
9	15	9.721621	10.278379	9.792198	10.207802	10.070577	9.929423	45	51
10	30	9.721672	10.278328	9.792269	10.207731	10.070597	9.929403	30	50
11	45	9.721723	10.278277	9.792340	10.207660	10.070616	9.929384	15	49
12	48	9.721774	10.278226	9.792410	10.207590	10.070636	9.929364	12	48
13	15	9.721825	10.278175	9.792481	10.207519	10.070656	9.929344	45	47
14	30	9.721876	10.278124	9.792551	10.207449	10.070675	9.929325	30	46
15	45	9.721927	10.278073	9.792622	10.207378	10.070695	9.929305	15	45
16	49	9.721978	10.278022	9.792692	10.207308	10.070714	9.929286	11	44
17	15	9.722029	10.277971	9.792763	10.207237	10.070734	9.929266	45	43
18	30	9.722080	10.277920	9.792833	10.207167	10.070754	9.929246	30	42
19	45	9.722130	10.277870	9.792904	10.207096	10.070773	9.929227	15	41
20	50	9.722181	10.277819	9.792974	10.207026	10.070793	9.929207	10	40
21	15	9.722232	10.277768	9.793045	10.206955	10.070812	9.929188	45	39
22	30	9.722283	10.277717	9.793115	10.206885	10.070832	9.929168	30	38
23	45	9.722334	10.277666	9.793185	10.206815	10.070852	9.929148	15	37
24	51	9.722385	10.277615	9.793256	10.206744	10.070871	9.929129	9	36
25	15	9.722436	10.277564	9.793326	10.206674	10.070891	9.929109	45	35
26	30	9.722486	10.277514	9.793397	10.206603	10.070910	9.929090	30	34
27	45	9.722537	10.277463	9.793467	10.206533	10.070930	9.929070	15	33
28	52	9.722588	10.277412	9.793538	10.206462	10.070950	9.929050	8	32
29	15	9.722639	10.277361	9.793608	10.206392	10.070969	9.929031	45	31
30	30	9.722690	10.277310	9.793679	10.206321	10.070989	9.929011	30	30
31	45	9.722740	10.277260	9.793749	10.206251	10.071009	9.928991	15	29
32	53	9.722791	10.277209	9.793819	10.206181	10.071028	9.928972	7	28
33	15	9.722842	10.277158	9.793890	10.206110	10.071048	9.928952	45	27
34	30	9.722893	10.277107	9.793960	10.206040	10.071068	9.928932	30	26
35	45	9.722944	10.277056	9.794031	10.205969	10.071087	9.928913	15	25
36	54	9.722994	10.277006	9.794101	10.205899	10.071107	9.928893	6	24
37	15	9.723045	10.276955	9.794171	10.205829	10.071127	9.928873	45	23
38	30	9.723096	10.276904	9.794242	10.205758	10.071146	9.928854	30	22
39	45	9.723146	10.276854	9.794312	10.205688	10.071166	9.928834	15	21
40	55	9.723197	10.276803	9.794383	10.205617	10.071186	9.928814	5	20
41	15	9.723248	10.276752	9.794453	10.205547	10.071205	9.928795	45	19
42	30	9.723299	10.276701	9.794523	10.205477	10.071225	9.928775	30	18
43	45	9.723349	10.276651	9.794594	10.205406	10.071245	9.928755	15	17
44	56	9.723400	10.276600	9.794664	10.205336	10.071264	9.928736	4	16
45	15	9.723451	10.276549	9.794734	10.205266	10.071284	9.928716	45	15
46	30	9.723501	10.276499	9.794805	10.205195	10.071304	9.928696	30	14
47	45	9.723552	10.276448	9.794875	10.205125	10.071323	9.928677	15	13
48	57	9.723603	10.276397	9.794945	10.205055	10.071343	9.928657	3	12
49	15	9.723653	10.276347	9.795016	10.204984	10.071363	9.928637	45	11
50	30	9.723704	10.276296	9.795086	10.204914	10.071382	9.928618	30	10
51	45	9.723754	10.276246	9.795156	10.204844	10.071402	9.928598	15	9
52	58	9.723805	10.276195	9.795227	10.204773	10.071422	9.928578	2	8
53	15	9.723856	10.276144	9.795297	10.204703	10.071441	9.928559	45	7
54	30	9.723906	10.276094	9.795367	10.204633	10.071461	9.928539	30	6
55	45	9.723957	10.276043	9.795438	10.204562	10.071481	9.928519	15	5
56	59	9.724007	10.275993	9.795508	10.204492	10.071501	9.928499	1	4
57	15	9.724058	10.275942	9.795578	10.204422	10.071520	9.928480	45	3
58	30	9.724109	10.275891	9.795649	10.204351	10.071540	9.928460	30	2
59	45	9.724159	10.275841	9.795719	10.204281	10.071560	9.928440	15	1
60	(60)	9.724210	10.275790	9.795789	10.204211	10.071580	9.928420	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

2 ^h 8 ^m .		LOG. SINES, &c. (t.)						32 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.724210	10.275790	9.795789	10.204211	10.071580	9.928420	60	60
1	15	9.724260	10.275740	9.795859	10.204141	10.071599	9.928401	45	59
2	30	9.724311	10.275689	9.795930	10.204070	10.071619	9.928381	30	58
3	45	9.724361	10.275639	9.796000	10.204000	10.071639	9.928361	15	57
4	1	9.724412	10.275588	9.796070	10.203930	10.071659	9.928341	59	56
5	15	9.724462	10.275538	9.796141	10.203859	10.071678	9.928322	45	55
6	30	9.724513	10.275487	9.796211	10.203789	10.071698	9.928302	30	54
7	45	9.724563	10.275437	9.796281	10.203719	10.071718	9.928282	15	53
8	2	9.724614	10.275386	9.796351	10.203649	10.071738	9.928262	58	52
9	15	9.724664	10.275336	9.796421	10.203579	10.071757	9.928243	45	51
10	30	9.724715	10.275285	9.796492	10.203508	10.071777	9.928223	30	50
11	45	9.724765	10.275235	9.796562	10.203438	10.071797	9.928203	15	49
12	3	9.724816	10.275184	9.796632	10.203368	10.071817	9.928183	57	48
13	15	9.724866	10.275134	9.796702	10.203298	10.071836	9.928164	45	47
14	30	9.724916	10.275084	9.796773	10.203227	10.071856	9.928144	30	46
15	45	9.724967	10.275033	9.796843	10.203157	10.071876	9.928124	15	45
16	4	9.725017	10.274983	9.796913	10.203087	10.071896	9.928104	56	44
17	15	9.725068	10.274932	9.796983	10.203017	10.071916	9.928084	45	43
18	30	9.725118	10.274882	9.797053	10.202947	10.071935	9.928065	30	42
19	45	9.725169	10.274831	9.797124	10.202876	10.071955	9.928045	15	41
20	5	9.725219	10.274781	9.797194	10.202806	10.071975	9.928025	55	40
21	15	9.725269	10.274731	9.797264	10.202736	10.071995	9.928005	45	39
22	30	9.725320	10.274680	9.797334	10.202666	10.072015	9.927985	30	38
23	45	9.725370	10.274630	9.797404	10.202596	10.072034	9.927966	15	37
24	6	9.725420	10.274580	9.797474	10.202526	10.072054	9.927946	54	36
25	15	9.725471	10.274529	9.797545	10.202455	10.072074	9.927926	45	35
26	30	9.725521	10.274479	9.797615	10.202385	10.072094	9.927906	30	34
27	45	9.725571	10.274429	9.797685	10.202315	10.072114	9.927886	15	33
28	7	9.725622	10.274378	9.797755	10.202245	10.072133	9.927867	53	32
29	15	9.725672	10.274328	9.797825	10.202175	10.072153	9.927847	45	31
30	30	9.725722	10.274278	9.797895	10.202105	10.072173	9.927827	30	30
31	45	9.725773	10.274227	9.797965	10.202035	10.072193	9.927807	15	29
32	8	9.725823	10.274177	9.798036	10.201964	10.072213	9.927787	52	28
33	15	9.725873	10.274127	9.798106	10.201894	10.072233	9.927767	45	27
34	30	9.725923	10.274077	9.798176	10.201824	10.072252	9.927748	30	26
35	45	9.725974	10.274026	9.798246	10.201754	10.072272	9.927728	15	25
36	9	9.726024	10.273976	9.798316	10.201684	10.072292	9.927708	51	24
37	15	9.726074	10.273926	9.798386	10.201614	10.072312	9.927688	45	23
38	30	9.726124	10.273876	9.798456	10.201544	10.072332	9.927668	30	22
39	45	9.726175	10.273825	9.798526	10.201474	10.072352	9.927648	15	21
40	10	9.726225	10.273775	9.798596	10.201404	10.072372	9.927628	50	20
41	15	9.726275	10.273725	9.798666	10.201334	10.072391	9.927609	45	19
42	30	9.726325	10.273675	9.798736	10.201264	10.072411	9.927589	30	18
43	45	9.726375	10.273625	9.798807	10.201193	10.072431	9.927569	15	17
44	11	9.726426	10.273574	9.798877	10.201123	10.072451	9.927549	49	16
45	15	9.726476	10.273524	9.798947	10.201053	10.072471	9.927529	45	15
46	30	9.726526	10.273474	9.799017	10.200983	10.072491	9.927509	30	14
47	45	9.726576	10.273424	9.799087	10.200913	10.072511	9.927489	15	13
48	12	9.726626	10.273374	9.799157	10.200843	10.072531	9.927469	48	12
49	15	9.726676	10.273324	9.799227	10.200773	10.072550	9.927450	45	11
50	30	9.726727	10.273273	9.799297	10.200703	10.072570	9.927430	30	10
51	45	9.726777	10.273223	9.799367	10.200633	10.072590	9.927410	15	9
52	13	9.726827	10.273173	9.799437	10.200563	10.072610	9.927390	47	8
53	15	9.726877	10.273123	9.799507	10.200493	10.072630	9.927370	45	7
54	30	9.726927	10.273073	9.799577	10.200423	10.072650	9.927350	30	6
55	45	9.726977	10.273023	9.799647	10.200353	10.072670	9.927330	15	5
56	14	9.727027	10.272973	9.799717	10.200283	10.072690	9.927310	46	4
57	15	9.727077	10.272923	9.799787	10.200213	10.072710	9.927290	45	3
58	30	9.727127	10.272873	9.799857	10.200143	10.072730	9.927270	30	2
59	45	9.727178	10.272822	9.799927	10.200073	10.072750	9.927250	15	1
60	15	9.727228	10.272772	9.799997	10.200003	10.072769	9.927231	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 51 ^m .		LOG. SINES, &c.						57 deg.	

2 ^h 9 ^m .		LOG. SINES, &c. (t.)						32 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.727228	10.272772	9.799997	10.200003	10.072769	9.927231	45	60
1	15	9.727278	10.272722	9.800067	10.199933	10.072789	9.927211	45	59
2	30	9.727328	10.272672	9.800137	10.199863	10.072809	9.927191	30	58
3	45	9.727378	10.272622	9.800207	10.199793	10.072829	9.927171	15	57
4	16	9.727428	10.272572	9.800277	10.199723	10.072849	9.927151	44	56
5	15	9.727478	10.272522	9.800347	10.199653	10.072869	9.927131	45	55
6	30	9.727528	10.272472	9.800417	10.199583	10.072889	9.927111	30	54
7	45	9.727578	10.272422	9.800487	10.199513	10.072909	9.927091	15	53
8	17	9.727628	10.272372	9.800557	10.199443	10.072929	9.927071	43	52
9	15	9.727678	10.272322	9.800627	10.199373	10.072949	9.927051	45	51
10	30	9.727728	10.272272	9.800697	10.199303	10.072969	9.927031	30	50
11	45	9.727778	10.272222	9.800766	10.199234	10.072989	9.927011	15	49
12	18	9.727828	10.272172	9.800836	10.199164	10.073009	9.926991	42	48
13	15	9.727878	10.272122	9.800906	10.199094	10.073029	9.926971	45	47
14	30	9.727928	10.272072	9.800976	10.199024	10.073049	9.926951	30	46
15	45	9.727978	10.272022	9.801046	10.198954	10.073069	9.926931	15	45
16	19	9.728027	10.271973	9.801116	10.198884	10.073089	9.926911	41	44
17	15	9.728077	10.271923	9.801186	10.198814	10.073109	9.926891	45	43
18	30	9.728127	10.271873	9.801256	10.198744	10.073129	9.926871	30	42
19	45	9.728177	10.271823	9.801326	10.198674	10.073149	9.926851	15	41
20	20	9.728227	10.271773	9.801396	10.198604	10.073169	9.926831	40	40
21	15	9.728277	10.271723	9.801466	10.198534	10.073189	9.926811	45	39
22	30	9.728327	10.271673	9.801535	10.198465	10.073209	9.926791	30	38
23	45	9.728377	10.271623	9.801605	10.198395	10.073229	9.926771	15	37
24	21	9.728427	10.271573	9.801675	10.198325	10.073249	9.926751	39	36
25	15	9.728476	10.271524	9.801745	10.198255	10.073269	9.926731	45	35
26	30	9.728526	10.271474	9.801815	10.198185	10.073289	9.926711	30	34
27	45	9.728576	10.271424	9.801885	10.198115	10.073309	9.926691	15	33
28	22	9.728626	10.271374	9.801955	10.198045	10.073329	9.926671	38	32
29	15	9.728676	10.271324	9.802024	10.197976	10.073349	9.926651	45	31
30	30	9.728726	10.271274	9.802094	10.197906	10.073369	9.926631	30	30
31	45	9.728775	10.271225	9.802164	10.197836	10.073389	9.926611	15	29
32	23	9.728825	10.271175	9.802234	10.197766	10.073409	9.926591	37	28
33	15	9.728875	10.271125	9.802304	10.197696	10.073429	9.926571	45	27
34	30	9.728925	10.271075	9.802374	10.197626	10.073449	9.926551	30	26
35	45	9.728975	10.271025	9.802443	10.197557	10.073469	9.926531	15	25
36	24	9.729024	10.270976	9.802513	10.197487	10.073489	9.926511	36	24
37	15	9.729074	10.270926	9.802583	10.197417	10.073509	9.926491	45	23
38	30	9.729124	10.270876	9.802653	10.197347	10.073529	9.926471	30	22
39	45	9.729174	10.270826	9.802723	10.197277	10.073549	9.926451	15	21
40	25	9.729223	10.270777	9.802792	10.197208	10.073569	9.926431	35	20
41	15	9.729273	10.270727	9.802862	10.197138	10.073589	9.926411	45	19
42	30	9.729323	10.270677	9.802932	10.197068	10.073609	9.926391	30	18
43	45	9.729373	10.270627	9.803002	10.196998	10.073629	9.926371	15	17
44	26	9.729422	10.270578	9.803072	10.196928	10.073649	9.926351	34	16
45	15	9.729472	10.270528	9.803141	10.196859	10.073669	9.926331	45	15
46	30	9.729522	10.270478	9.803211	10.196789	10.073689	9.926311	30	14
47	45	9.729571	10.270429	9.803281	10.196719	10.073710	9.926290	15	13
48	27	9.729621	10.270379	9.803351	10.196649	10.073730	9.926270	33	12
49	15	9.729671	10.270329	9.803420	10.196580	10.073750	9.926250	45	11
50	30	9.729720	10.270280	9.803490	10.196510	10.073770	9.926230	30	10
51	45	9.729770	10.270230	9.803560	10.196440	10.073790	9.926210	15	9
52	28	9.729820	10.270180	9.803630	10.196370	10.073810	9.926190	32	8
53	15	9.729869	10.270131	9.803699	10.196300	10.073830	9.926170	45	7
54	30	9.729919	10.270081	9.803769	10.196231	10.073850	9.926150	30	6
55	45	9.729968	10.270032	9.803839	10.196161	10.073870	9.926130	15	5
56	29	9.730018	10.269982	9.803908	10.196092	10.073890	9.926110	31	4
57	15	9.730068	10.269932	9.803978	10.196022	10.073911	9.926089	45	3
58	30	9.730117	10.269883	9.804048	10.195952	10.073931	9.926069	30	2
59	45	9.730167	10.269833	9.804118	10.195882	10.073951	9.926049	15	1
60	30	9.730216	10.269784	9.804187	10.195813	10.073971	9.926029	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 50 ^m .		LOG. SINES, &c.						57 deg	

2 ^h 10 ^m .		LOG. SINES, &c. (L.)						32 deg.	
sec.		sine.	cosecant.	tangent.	cotangent.	secant.	cosine.		sec.
0	30	9.730216	10.269784	9.804187	10.195813	10.073971	9.926029	30	60
1	15	9.730266	10.269734	9.804257	10.195743	10.073991	9.926009	45	59
2	30	9.730316	10.269684	9.804327	10.195673	10.074011	9.925989	30	58
3	45	9.730365	10.269635	9.804396	10.195604	10.074031	9.925969	15	57
4	31	9.730415	10.269585	9.804466	10.195534	10.074051	9.925949	29	56
5	15	9.730464	10.269536	9.804536	10.195464	10.074072	9.925928	45	55
6	30	9.730514	10.269486	9.804605	10.195395	10.074092	9.925908	30	54
7	45	9.730563	10.269437	9.804675	10.195325	10.074112	9.925888	15	53
8	32	9.730613	10.269387	9.804745	10.195255	10.074132	9.925868	28	52
9	15	9.730662	10.269338	9.804814	10.195186	10.074152	9.925848	45	51
10	30	9.730712	10.269288	9.804884	10.195116	10.074172	9.925828	30	50
11	45	9.730761	10.269239	9.804954	10.195046	10.074192	9.925808	15	49
12	33	9.730811	10.269189	9.805023	10.194977	10.074213	9.925787	27	48
13	15	9.730860	10.269140	9.805093	10.194907	10.074233	9.925767	45	47
14	30	9.730910	10.269090	9.805163	10.194837	10.074253	9.925747	30	46
15	45	9.730959	10.269041	9.805232	10.194768	10.074273	9.925727	15	45
16	34	9.731009	10.268991	9.805302	10.194698	10.074293	9.925707	26	44
17	15	9.731058	10.268942	9.805371	10.194629	10.074313	9.925687	45	43
18	30	9.731108	10.268892	9.805441	10.194559	10.074334	9.925666	30	42
19	45	9.731157	10.268843	9.805511	10.194489	10.074354	9.925646	15	41
20	35	9.731206	10.268794	9.805580	10.194420	10.074374	9.925626	25	40
21	15	9.731256	10.268744	9.805650	10.194350	10.074394	9.925606	45	39
22	30	9.731305	10.268695	9.805719	10.194281	10.074414	9.925586	30	38
23	45	9.731355	10.268645	9.805789	10.194211	10.074434	9.925566	15	37
24	36	9.731404	10.268596	9.805859	10.194141	10.074455	9.925545	24	36
25	15	9.731453	10.268547	9.805928	10.194072	10.074475	9.925525	45	35
26	30	9.731503	10.268497	9.805998	10.194002	10.074495	9.925505	30	34
27	45	9.731552	10.268448	9.806067	10.193933	10.074515	9.925485	15	33
28	37	9.731601	10.268399	9.806137	10.193863	10.074535	9.925465	23	32
29	15	9.731651	10.268349	9.806206	10.193794	10.074556	9.925444	45	31
30	30	9.731700	10.268300	9.806276	10.193724	10.074576	9.925424	30	30
31	45	9.731749	10.268251	9.806346	10.193654	10.074596	9.925404	15	29
32	38	9.731799	10.268201	9.806415	10.193585	10.074616	9.925384	22	28
33	15	9.731848	10.268152	9.806485	10.193515	10.074637	9.925363	45	27
34	30	9.731897	10.268103	9.806554	10.193446	10.074657	9.925343	30	26
35	45	9.731947	10.268053	9.806624	10.193376	10.074677	9.925323	15	25
36	39	9.731996	10.268004	9.806693	10.193307	10.074697	9.925303	21	24
37	15	9.732045	10.267955	9.806763	10.193237	10.074718	9.925282	45	23
38	30	9.732095	10.267905	9.806832	10.193168	10.074738	9.925262	30	22
39	45	9.732144	10.267856	9.806902	10.193098	10.074758	9.925242	15	21
40	40	9.732193	10.267807	9.806971	10.193029	10.074778	9.925222	20	20
41	15	9.732242	10.267758	9.807041	10.192959	10.074799	9.925201	45	19
42	30	9.732292	10.267708	9.807110	10.192890	10.074819	9.925181	30	18
43	45	9.732341	10.267659	9.807180	10.192820	10.074839	9.925161	15	17
44	41	9.732390	10.267610	9.807249	10.192751	10.074859	9.925141	19	16
45	15	9.732439	10.267561	9.807319	10.192681	10.074880	9.925120	45	15
46	30	9.732489	10.267511	9.807388	10.192612	10.074900	9.925100	30	14
47	45	9.732538	10.267462	9.807458	10.192542	10.074920	9.925080	15	13
48	42	9.732587	10.267413	9.807527	10.192473	10.074940	9.925060	18	12
49	15	9.732636	10.267364	9.807597	10.192403	10.074961	9.925039	45	11
50	30	9.732685	10.267315	9.807666	10.192334	10.074981	9.925019	30	10
51	45	9.732734	10.267266	9.807736	10.192264	10.075001	9.924999	15	9
52	43	9.732784	10.267216	9.807805	10.192195	10.075021	9.924979	17	8
53	15	9.732833	10.267167	9.807875	10.192125	10.075042	9.924958	45	7
54	30	9.732882	10.267118	9.807944	10.192056	10.075062	9.924938	30	6
55	45	9.732931	10.267069	9.808013	10.191987	10.075082	9.924918	15	5
56	44	9.732980	10.267020	9.808083	10.191917	10.075103	9.924897	16	4
57	15	9.733029	10.266971	9.808152	10.191848	10.075123	9.924877	45	3
58	30	9.733079	10.266921	9.808222	10.191778	10.075143	9.924857	30	2
59	45	9.733128	10.266872	9.808291	10.191709	10.075164	9.924836	15	1
60	45	9.733177	10.266823	9.808361	10.191639	10.075184	9.924816	15	0
sec.		cosine.	secant.	cotangent.	tangent.	cosecant.	sine.		sec.
3 ^h 49 ^m .		LOG. SINES, &c.						57 deg.	

2 ^h 11 ^m .		LOG. SINES, &c. (t.)						32 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	45	9.733177	10.266823	9.808361	10.191639	10.075184	9.924816	15		60
1	15	9.733226	10.266774	9.808430	10.191570	10.075204	9.924796	45		59
2	30	9.733275	10.266725	9.808499	10.191501	10.075225	9.924775	30		58
3	45	9.733324	10.266676	9.808569	10.191431	10.075245	9.924755	15		57
4	46	9.733373	10.266627	9.808638	10.191362	10.075265	9.924735	14		56
5	15	9.733422	10.266578	9.808708	10.191292	10.075286	9.924714	45		55
6	30	9.733471	10.266529	9.808777	10.191223	10.075306	9.924694	30		54
7	45	9.733520	10.266480	9.808846	10.191154	10.075326	9.924674	15		53
8	47	9.733569	10.266431	9.808916	10.191084	10.075347	9.924653	13		52
9	15	9.733618	10.266382	9.808985	10.191015	10.075367	9.924633	45		51
10	30	9.733667	10.266333	9.809055	10.190945	10.075387	9.924613	30		50
11	45	9.733716	10.266284	9.809124	10.190876	10.075408	9.924592	15		49
12	48	9.733765	10.266235	9.809193	10.190807	10.075428	9.924572	12		48
13	15	9.733814	10.266186	9.809263	10.190737	10.075448	9.924552	45		47
14	30	9.733863	10.266137	9.809332	10.190668	10.075469	9.924531	30		46
15	45	9.733912	10.266088	9.809401	10.190599	10.075489	9.924511	15		45
16	49	9.733961	10.266039	9.809471	10.190529	10.075509	9.924491	11		44
17	15	9.734010	10.265990	9.809540	10.190460	10.075530	9.924470	45		43
18	30	9.734059	10.265941	9.809609	10.190391	10.075550	9.924450	30		42
19	45	9.734108	10.265892	9.809679	10.190321	10.075570	9.924430	15		41
20	50	9.734157	10.265843	9.809748	10.190252	10.075591	9.924409	10		40
21	15	9.734206	10.265794	9.809817	10.190183	10.075611	9.924389	45		39
22	30	9.734255	10.265745	9.809887	10.190113	10.075632	9.924368	30		38
23	45	9.734304	10.265696	9.809956	10.190044	10.075652	9.924348	15		37
24	51	9.734353	10.265647	9.810025	10.189975	10.075672	9.924328	9		36
25	15	9.734402	10.265598	9.810095	10.189905	10.075693	9.924307	45		35
26	30	9.734451	10.265549	9.810164	10.189836	10.075713	9.924287	30		34
27	45	9.734500	10.265500	9.810233	10.189767	10.075734	9.924266	15		33
28	52	9.734548	10.265452	9.810302	10.189698	10.075754	9.924246	8		32
29	15	9.734597	10.265403	9.810372	10.189628	10.075774	9.924226	45		31
30	30	9.734646	10.265354	9.810441	10.189559	10.075795	9.924205	30		30
31	45	9.734695	10.265305	9.810510	10.189490	10.075815	9.924185	15		29
32	53	9.734744	10.265256	9.810580	10.189420	10.075836	9.924164	7		28
33	15	9.734793	10.265207	9.810649	10.189351	10.075856	9.924144	45		27
34	30	9.734842	10.265158	9.810718	10.189282	10.075876	9.924124	30		26
35	45	9.734890	10.265110	9.810787	10.189213	10.075897	9.924103	15		25
36	54	9.734939	10.265061	9.810857	10.189143	10.075917	9.924083	6		24
37	15	9.734988	10.265012	9.810926	10.189074	10.075938	9.924062	45		23
38	30	9.735037	10.264963	9.810995	10.189005	10.075958	9.924042	30		22
39	45	9.735086	10.264914	9.811064	10.188936	10.075979	9.924021	15		21
40	55	9.735134	10.264866	9.811134	10.188866	10.075999	9.924001	5		20
41	15	9.735183	10.264817	9.811203	10.188797	10.076020	9.923980	45		19
42	30	9.735232	10.264768	9.811272	10.188728	10.076040	9.923960	30		18
43	45	9.735281	10.264719	9.811341	10.188659	10.076060	9.923940	15		17
44	56	9.735330	10.264670	9.811410	10.188590	10.076081	9.923919	4		16
45	15	9.735378	10.264622	9.811480	10.188520	10.076101	9.923899	45		15
46	30	9.735427	10.264573	9.811549	10.188451	10.076122	9.923878	30		14
47	45	9.735476	10.264524	9.811618	10.188382	10.076142	9.923858	15		13
48	57	9.735525	10.264475	9.811687	10.188313	10.076163	9.923837	3		12
49	15	9.735573	10.264427	9.811756	10.188244	10.076183	9.923817	45		11
50	30	9.735622	10.264378	9.811826	10.188174	10.076204	9.923796	30		10
51	45	9.735671	10.264329	9.811895	10.188105	10.076224	9.923776	15		9
52	58	9.735719	10.264281	9.811964	10.188036	10.076245	9.923755	2		8
53	15	9.735768	10.264232	9.812033	10.187967	10.076265	9.923735	45		7
54	30	9.735817	10.264183	9.812102	10.187898	10.076286	9.923714	30		6
55	45	9.735865	10.264135	9.812172	10.187828	10.076306	9.923694	15		5
56	59	9.735914	10.264086	9.812241	10.187759	10.076327	9.923673	1		4
57	15	9.735963	10.264037	9.812310	10.187690	10.076347	9.923653	45		3
58	30	9.736011	10.263989	9.812379	10.187621	10.076368	9.923632	30		2
59	45	9.736060	10.263940	9.812448	10.187552	10.076388	9.923612	15		1
60	60	9.736109	10.263891	9.812517	10.187483	10.076409	9.923591	0		0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
3 48 ^m .		LOG. SINES &c.						57 deg.		

2° 12m.			LOG. SINES, &c. (t.)						33 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.		
0	0	9.736109	10.263391	9.812517	10.187483	10.076409	9.923591	60	60		
1	15	9.736157	10.263843	9.812586	10.187414	10.076429	9.923571	45	59		
2	30	9.736206	10.263794	9.812656	10.187344	10.076450	9.923550	30	58		
3	45	9.736255	10.263745	9.812725	10.187275	10.076470	9.923530	15	57		
4	1	9.736303	10.263697	9.812794	10.187206	10.076491	9.923509	59	56		
5	15	9.736352	10.263648	9.812863	10.187137	10.076511	9.923489	45	55		
6	30	9.736400	10.263600	9.812932	10.187068	10.076532	9.923468	30	54		
7	45	9.736449	10.263551	9.813001	10.186999	10.076552	9.923448	15	53		
8	2	9.736498	10.263502	9.813070	10.186930	10.076573	9.923427	58	52		
9	15	9.736546	10.263454	9.813139	10.186861	10.076593	9.923407	45	51		
10	30	9.736595	10.263405	9.813209	10.186791	10.076614	9.923386	30	50		
11	45	9.736643	10.263357	9.813278	10.186722	10.076634	9.923366	15	49		
12	3	9.736692	10.263308	9.813347	10.186653	10.076655	9.923345	57	48		
13	15	9.736740	10.263260	9.813416	10.186584	10.076676	9.923324	45	47		
14	30	9.736789	10.263211	9.813485	10.186515	10.076696	9.923304	30	46		
15	45	9.736837	10.263163	9.813554	10.186446	10.076717	9.923283	15	45		
16	4	9.736886	10.263114	9.813623	10.186377	10.076737	9.923263	56	44		
17	15	9.736934	10.263066	9.813692	10.186308	10.076758	9.923242	45	43		
18	30	9.736983	10.263017	9.813761	10.186239	10.076778	9.923222	30	42		
19	45	9.737031	10.262969	9.813830	10.186170	10.076799	9.923201	15	41		
20	5	9.737080	10.262920	9.813899	10.186101	10.076820	9.923180	55	40		
21	15	9.737128	10.262872	9.813968	10.186032	10.076840	9.923160	45	39		
22	30	9.737177	10.262823	9.814037	10.185963	10.076861	9.923139	30	38		
23	45	9.737225	10.262775	9.814106	10.185894	10.076881	9.923119	15	37		
24	6	9.737274	10.262726	9.814175	10.185825	10.076902	9.923098	54	36		
25	15	9.737322	10.262678	9.814245	10.185755	10.076922	9.923078	45	35		
26	30	9.737371	10.262629	9.814314	10.185686	10.076943	9.923057	30	34		
27	45	9.737419	10.262581	9.814383	10.185617	10.076964	9.923036	15	33		
28	7	9.737467	10.262533	9.814452	10.185548	10.076984	9.923016	53	32		
29	15	9.737516	10.262484	9.814521	10.185479	10.077005	9.922995	45	31		
30	30	9.737564	10.262436	9.814590	10.185410	10.077025	9.922975	30	30		
31	45	9.737613	10.262387	9.814659	10.185341	10.077046	9.922954	15	29		
32	8	9.737661	10.262339	9.814728	10.185272	10.077067	9.922933	52	28		
33	15	9.737709	10.262291	9.814797	10.185203	10.077087	9.922913	45	27		
34	30	9.737758	10.262242	9.814866	10.185134	10.077108	9.922892	30	26		
35	45	9.737806	10.262194	9.814935	10.185065	10.077129	9.922871	15	25		
36	9	9.737855	10.262145	9.815004	10.184996	10.077149	9.922851	51	24		
37	15	9.737903	10.262097	9.815073	10.184927	10.077170	9.922830	45	23		
38	30	9.737951	10.262049	9.815142	10.184858	10.077190	9.922810	30	22		
39	45	9.738000	10.262000	9.815211	10.184789	10.077211	9.922789	15	21		
40	10	9.738048	10.261952	9.815279	10.184721	10.077232	9.922768	50	20		
41	15	9.738096	10.261904	9.815348	10.184652	10.077252	9.922748	45	19		
42	30	9.738145	10.261855	9.815417	10.184583	10.077273	9.922727	30	18		
43	45	9.738193	10.261807	9.815486	10.184514	10.077294	9.922706	15	17		
44	11	9.738241	10.261759	9.815555	10.184445	10.077314	9.922686	49	16		
45	15	9.738289	10.261711	9.815624	10.184376	10.077335	9.922665	45	15		
46	30	9.738338	10.261662	9.815693	10.184307	10.077356	9.922644	30	14		
47	45	9.738386	10.261614	9.815762	10.184238	10.077376	9.922624	15	13		
48	12	9.738434	10.261566	9.815831	10.184169	10.077397	9.922603	48	12		
49	15	9.738482	10.261518	9.815900	10.184100	10.077418	9.922582	45	11		
50	30	9.738531	10.261469	9.815969	10.184031	10.077438	9.922562	30	10		
51	45	9.738579	10.261421	9.816038	10.183962	10.077459	9.922541	15	9		
52	13	9.738627	10.261373	9.816107	10.183893	10.077480	9.922520	47	8		
53	15	9.738675	10.261325	9.816176	10.183824	10.077500	9.922500	45	7		
54	30	9.738724	10.261276	9.816245	10.183755	10.077521	9.922479	30	6		
55	45	9.738772	10.261228	9.816313	10.183687	10.077542	9.922458	15	5		
56	14	9.738820	10.261180	9.816382	10.183618	10.077562	9.922438	46	4		
57	15	9.738868	10.261132	9.816451	10.183549	10.077583	9.922417	45	3		
58	30	9.738916	10.261084	9.816520	10.183480	10.077604	9.922396	30	2		
59	45	9.738965	10.261035	9.816589	10.183411	10.077624	9.922376	15	1		
60	15	9.739013	10.260987	9.816658	10.183342	10.077645	9.922355	45	0		
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.		
3° 47m.			LOG. SINES, &c.						56 deg.		

2 ^h 13 ^m .		LOG. SINES, &c. (t.)						33 deg.	
sec.	"	sine.	coscant.	tang-nt.	cotangent.	secant.	cosine.	"	sec.
0	15	9.739013	10.260987	9.816658	10.183342	10.077645	9.922355	45	60
1	15	9.739061	10.260939	9.816727	10.183273	10.077666	9.922334	45	59
2	30	9.739109	10.260891	9.816796	10.183204	10.077687	9.922313	30	58
3	45	9.739157	10.260843	9.816865	10.183135	10.077707	9.922293	15	57
4	16	9.739205	10.260795	9.816933	10.183067	10.077728	9.922272	44	56
5	15	9.739254	10.260746	9.817002	10.182998	10.077749	9.922251	45	55
6	30	9.739302	10.260698	9.817071	10.182929	10.077769	9.922231	30	54
7	45	9.739350	10.260650	9.817140	10.182860	10.077790	9.922210	15	53
8	17	9.739398	10.260602	9.817209	10.182791	10.077811	9.922189	43	52
9	15	9.739446	10.260554	9.817278	10.182722	10.077832	9.922168	45	51
10	30	9.739494	10.260506	9.817346	10.182654	10.077852	9.922148	30	50
11	45	9.739542	10.260458	9.817415	10.182585	10.077873	9.922127	15	49
12	18	9.739590	10.260410	9.817484	10.182516	10.077894	9.922106	42	48
13	15	9.739638	10.260362	9.817553	10.182447	10.077915	9.922085	45	47
14	30	9.739686	10.260314	9.817622	10.182378	10.077935	9.922065	30	46
15	45	9.739735	10.260265	9.817691	10.182309	10.077956	9.922044	15	45
16	19	9.739783	10.260217	9.817759	10.182241	10.077977	9.922023	41	44
17	15	9.739831	10.260169	9.817828	10.182172	10.077998	9.922002	45	43
18	30	9.739879	10.260121	9.817897	10.182103	10.078018	9.921982	30	42
19	45	9.739927	10.260073	9.817966	10.182034	10.078039	9.921961	15	41
20	20	9.739975	10.260025	9.818035	10.181965	10.078060	9.921940	40	40
21	15	9.740023	10.259977	9.818103	10.181897	10.078081	9.921919	45	39
22	30	9.740071	10.259929	9.818172	10.181828	10.078101	9.921899	30	38
23	45	9.740119	10.259881	9.818241	10.181759	10.078122	9.921878	15	37
24	21	9.740167	10.259833	9.818310	10.181690	10.078143	9.921857	39	36
25	15	9.740215	10.259785	9.818379	10.181621	10.078164	9.921836	45	35
26	30	9.740263	10.259737	9.818447	10.181553	10.078185	9.921815	30	34
27	45	9.740311	10.259689	9.818516	10.181484	10.078205	9.921795	15	33
28	22	9.740359	10.259641	9.818585	10.181415	10.078226	9.921774	38	32
29	15	9.740407	10.259593	9.818654	10.181346	10.078247	9.921753	45	31
30	30	9.740455	10.259545	9.818722	10.181278	10.078268	9.921732	30	30
31	45	9.740502	10.259498	9.818791	10.181209	10.078289	9.921711	15	29
32	23	9.740550	10.259450	9.818860	10.181140	10.078309	9.921691	37	28
33	15	9.740598	10.259402	9.818929	10.181071	10.078330	9.921670	45	27
34	30	9.740646	10.259354	9.818997	10.181003	10.078351	9.921649	30	26
35	45	9.740694	10.259306	9.819066	10.180934	10.078372	9.921628	15	25
36	24	9.740742	10.259258	9.819135	10.180865	10.078393	9.921607	36	24
37	15	9.740790	10.259210	9.819203	10.180797	10.078414	9.921586	45	23
38	30	9.740838	10.259162	9.819272	10.180728	10.078434	9.921566	30	22
39	45	9.740886	10.259114	9.819341	10.180659	10.078455	9.921545	15	21
40	25	9.740934	10.259066	9.819410	10.180590	10.078476	9.921524	35	20
41	15	9.740981	10.259019	9.819478	10.180522	10.078497	9.921503	45	19
42	30	9.741029	10.258971	9.819547	10.180453	10.078518	9.921482	30	18
43	45	9.741077	10.258923	9.819616	10.180384	10.078539	9.921461	15	17
44	26	9.741125	10.258875	9.819684	10.180316	10.078559	9.921441	34	16
45	15	9.741173	10.258827	9.819753	10.180247	10.078580	9.921420	45	15
46	30	9.741221	10.258779	9.819822	10.180178	10.078601	9.921399	30	14
47	45	9.741268	10.258732	9.819890	10.180110	10.078622	9.921378	15	13
48	27	9.741316	10.258684	9.819959	10.180041	10.078643	9.921357	33	12
49	15	9.741364	10.258636	9.820028	10.179972	10.078664	9.921336	45	11
50	30	9.741412	10.258588	9.820096	10.179904	10.078685	9.921315	30	10
51	45	9.741460	10.258540	9.820165	10.179835	10.078705	9.921295	15	9
52	28	9.741507	10.258493	9.820234	10.179766	10.078726	9.921274	32	8
53	15	9.741555	10.258445	9.820302	10.179698	10.078747	9.921253	45	7
54	30	9.741603	10.258397	9.820371	10.179629	10.078768	9.921232	30	6
55	45	9.741651	10.258349	9.820440	10.179560	10.078789	9.921211	15	5
56	29	9.741699	10.258301	9.820508	10.179492	10.078810	9.921190	31	4
57	15	9.741746	10.258254	9.820577	10.179423	10.078831	9.921169	45	3
58	30	9.741794	10.258206	9.820646	10.179354	10.078852	9.921148	30	2
59	45	9.741842	10.258158	9.820714	10.179286	10.078873	9.921127	15	1
60	30	9.741889	10.258111	9.820783	10.179217	10.078893	9.921107	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 46 ^m .		LOG. SINES, &c.						56 deg.	

2 ^h 14 ^m .		LOG. SINES, &c. (t.)						33 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	30	9.741889	10.258111	9.820783	10.179217	10.078893	9.921107	30		60
1	15	9.741937	10.258063	9.820851	10.179149	10.078914	9.921086	45		59
2	30	9.741985	10.258015	9.820920	10.179080	10.078935	9.921065	30		58
3	45	9.742033	10.257967	9.820989	10.179011	10.078956	9.921044	15		57
4	31	9.742080	10.257920	9.821057	10.178943	10.078977	9.921023	29		56
5	15	9.742128	10.257872	9.821126	10.178874	10.078998	9.921002	45		55
6	30	9.742176	10.257824	9.821195	10.178805	10.079019	9.920981	30		54
7	45	9.742223	10.257777	9.821263	10.178737	10.079040	9.920960	15		53
8	32	9.742271	10.257729	9.821332	10.178668	10.079061	9.920939	28		52
9	15	9.742319	10.257681	9.821400	10.178600	10.079082	9.920918	45		51
10	30	9.742366	10.257634	9.821469	10.178531	10.079103	9.920897	30		50
11	45	9.742414	10.257586	9.821537	10.178463	10.079124	9.920876	15		49
12	33	9.742462	10.257538	9.821606	10.178394	10.079145	9.920855	27		48
13	15	9.742509	10.257491	9.821675	10.178325	10.079165	9.920835	45		47
14	30	9.742557	10.257443	9.821743	10.178257	10.079186	9.920814	30		46
15	45	9.742604	10.257396	9.821812	10.178188	10.079207	9.920793	15		45
16	34	9.742652	10.257348	9.821880	10.178120	10.079228	9.920772	26		44
17	15	9.742700	10.257300	9.821949	10.178051	10.079249	9.920751	45		43
18	30	9.742747	10.257253	9.822017	10.177983	10.079270	9.920730	30		42
19	45	9.742795	10.257205	9.822086	10.177914	10.079291	9.920709	15		41
20	35	9.742842	10.257158	9.822154	10.177846	10.079312	9.920688	25		40
21	15	9.742890	10.257110	9.822223	10.177777	10.079333	9.920667	45		39
22	30	9.742937	10.257063	9.822291	10.177709	10.079354	9.920646	30		38
23	45	9.742985	10.257015	9.822360	10.177640	10.079375	9.920625	15		37
24	36	9.743032	10.256968	9.822429	10.177571	10.079396	9.920604	24		36
25	15	9.743080	10.256920	9.822497	10.177503	10.079417	9.920583	45		35
26	30	9.743128	10.256872	9.822566	10.177434	10.079438	9.920562	30		34
27	45	9.743175	10.256825	9.822634	10.177366	10.079459	9.920541	15		33
28	37	9.743223	10.256777	9.822703	10.177297	10.079480	9.920520	23		32
29	15	9.743270	10.256730	9.822771	10.177229	10.079501	9.920499	45		31
30	30	9.743318	10.256682	9.822840	10.177160	10.079522	9.920478	30		30
31	45	9.743365	10.256635	9.822908	10.177092	10.079543	9.920457	15		29
32	38	9.743413	10.256587	9.822977	10.177023	10.079564	9.920436	22		28
33	15	9.743460	10.256540	9.823045	10.176955	10.079585	9.920415	45		27
34	30	9.743507	10.256493	9.823114	10.176886	10.079606	9.920394	30		26
35	45	9.743555	10.256445	9.823182	10.176818	10.079627	9.920373	15		25
36	39	9.743602	10.256398	9.823250	10.176750	10.079648	9.920352	21		24
37	15	9.743650	10.256350	9.823319	10.176681	10.079669	9.920331	45		23
38	30	9.743697	10.256303	9.823387	10.176613	10.079690	9.920310	30		22
39	45	9.743745	10.256255	9.823456	10.176544	10.079711	9.920289	15		21
40	40	9.743792	10.256208	9.823524	10.176476	10.079732	9.920268	20		20
41	15	9.743840	10.256160	9.823593	10.176407	10.079753	9.920247	45		19
42	30	9.743887	10.256113	9.823661	10.176339	10.079774	9.920226	30		18
43	45	9.743934	10.256066	9.823730	10.176270	10.079795	9.920205	15		17
44	41	9.743982	10.256018	9.823798	10.176202	10.079816	9.920184	19		16
45	15	9.744029	10.255971	9.823867	10.176133	10.079837	9.920163	45		15
46	30	9.744076	10.255924	9.823935	10.176065	10.079859	9.920141	30		14
47	45	9.744124	10.255876	9.824003	10.175997	10.079880	9.920120	15		13
48	42	9.744171	10.255829	9.824072	10.175928	10.079901	9.920099	18		12
49	15	9.744219	10.255781	9.824140	10.175860	10.079922	9.920078	45		11
50	30	9.744266	10.255734	9.824209	10.175791	10.079943	9.920057	30		10
51	45	9.744313	10.255687	9.824277	10.175723	10.079964	9.920036	15		9
52	43	9.744361	10.255639	9.824345	10.175655	10.079985	9.920015	17		8
53	15	9.744408	10.255592	9.824414	10.175586	10.080006	9.919994	45		7
54	30	9.744455	10.255545	9.824482	10.175518	10.080027	9.919973	30		6
55	45	9.744502	10.255498	9.824551	10.175449	10.080048	9.919952	15		5
56	44	9.744550	10.255450	9.824619	10.175381	10.080069	9.919931	16		4
57	15	9.744597	10.255403	9.824687	10.175313	10.080090	9.919910	45		3
58	30	9.744644	10.255356	9.824756	10.175244	10.080111	9.919889	30		2
59	45	9.744692	10.255308	9.824824	10.175176	10.080133	9.919867	15		1
60	45	9.744739	10.255261	9.824893	10.175107	10.080154	9.919846	15		0
sec.		cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	'	sec.

2 ^h 15 ^m		LOG. SINES, &c. (1.)						33 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine	"	sec.
0	45	9.744739	10.255261	9.824893	10.175107	10.080154	9.919846	15	60
1	15	9.744786	10.255214	9.824961	10.175039	10.080175	9.919825	45	59
2	30	9.744833	10.255167	9.825029	10.174971	10.080196	9.919804	30	58
3	45	9.744881	10.255119	9.825098	10.174902	10.080217	9.919783	15	57
4	46	9.744928	10.255072	9.825166	10.174834	10.080238	9.919762	14	56
5	15	9.744975	10.255025	9.825234	10.174766	10.080259	9.919741	45	55
6	30	9.745022	10.254978	9.825303	10.174697	10.080280	9.919720	30	54
7	45	9.745070	10.254930	9.825371	10.174629	10.080301	9.919699	15	53
8	47	9.745117	10.254883	9.825439	10.174561	10.080323	9.919677	13	52
9	15	9.745164	10.254836	9.825508	10.174492	10.080344	9.919656	45	51
10	30	9.745211	10.254789	9.825576	10.174424	10.080365	9.919635	30	50
11	45	9.745258	10.254742	9.825644	10.174356	10.080386	9.919614	15	49
12	48	9.745306	10.254694	9.825713	10.174287	10.080407	9.919593	12	48
13	15	9.745353	10.254647	9.825781	10.174219	10.080428	9.919572	45	47
14	30	9.745400	10.254600	9.825849	10.174151	10.080449	9.919551	30	46
15	45	9.745447	10.254553	9.825918	10.174082	10.080471	9.919529	15	45
16	49	9.745494	10.254506	9.825986	10.174014	10.080492	9.919508	11	44
17	15	9.745541	10.254459	9.826054	10.173946	10.080513	9.919487	45	43
18	30	9.745589	10.254411	9.826123	10.173877	10.080534	9.919466	30	42
19	45	9.745636	10.254364	9.826191	10.173809	10.080555	9.919445	15	41
20	50	9.745683	10.254317	9.826259	10.173741	10.080576	9.919424	10	40
21	15	9.745730	10.254270	9.826327	10.173673	10.080598	9.919402	45	39
22	30	9.745777	10.254223	9.826396	10.173604	10.080619	9.919381	30	38
23	45	9.745824	10.254176	9.826464	10.173536	10.080640	9.919360	15	37
24	51	9.745871	10.254129	9.826532	10.173468	10.080661	9.919339	9	36
25	15	9.745918	10.254082	9.826601	10.173399	10.080682	9.919318	45	35
26	30	9.745965	10.254035	9.826669	10.173331	10.080703	9.919297	30	34
27	45	9.746012	10.253988	9.826737	10.173263	10.080725	9.919275	15	33
28	52	9.746059	10.253941	9.826805	10.173195	10.080746	9.919254	8	32
29	15	9.746107	10.253893	9.826874	10.173126	10.080767	9.919233	45	31
30	30	9.746154	10.253846	9.826942	10.173058	10.080788	9.919212	30	30
31	45	9.746201	10.253799	9.827010	10.172990	10.080809	9.919191	15	29
32	53	9.746248	10.253752	9.827078	10.172922	10.080831	9.919169	7	28
33	15	9.746295	10.253705	9.827147	10.172853	10.080852	9.919148	45	27
34	30	9.746342	10.253658	9.827215	10.172785	10.080873	9.919127	30	26
35	45	9.746389	10.253611	9.827283	10.172717	10.080894	9.919106	15	25
36	54	9.746436	10.253564	9.827351	10.172649	10.080916	9.919084	6	24
37	15	9.746483	10.253517	9.827419	10.172581	10.080937	9.919063	45	23
38	30	9.746530	10.253470	9.827488	10.172512	10.080958	9.919042	30	22
39	45	9.746577	10.253423	9.827556	10.172444	10.080979	9.919021	15	21
40	55	9.746624	10.253376	9.827624	10.172376	10.081000	9.919000	5	20
41	15	9.746671	10.253329	9.827692	10.172308	10.081022	9.918978	45	19
42	30	9.746718	10.253282	9.827760	10.172240	10.081043	9.918957	30	18
43	45	9.746765	10.253235	9.827829	10.172171	10.081064	9.918936	15	17
44	56	9.746811	10.253188	9.827897	10.172103	10.081085	9.918915	4	16
45	15	9.746858	10.253142	9.827965	10.172035	10.081107	9.918893	45	15
46	30	9.746905	10.253095	9.828033	10.171967	10.081128	9.918872	30	14
47	45	9.746952	10.253048	9.828101	10.171899	10.081149	9.918851	15	13
48	57	9.746999	10.253001	9.828170	10.171830	10.081170	9.918830	3	12
49	15	9.747046	10.252954	9.828238	10.171762	10.081192	9.918808	45	11
50	30	9.747093	10.252907	9.828306	10.171694	10.081213	9.918787	30	10
51	45	9.747140	10.252860	9.828374	10.171626	10.081234	9.918766	15	9
52	58	9.747187	10.252813	9.828442	10.171558	10.081256	9.918744	2	8
53	15	9.747234	10.252766	9.828510	10.171490	10.081277	9.918723	45	7
54	30	9.747281	10.252719	9.828579	10.171421	10.081298	9.918702	30	6
55	45	9.747327	10.252673	9.828647	10.171353	10.081319	9.918681	15	5
56	59	9.747374	10.252626	9.828715	10.171285	10.081341	9.918659	1	4
57	15	9.747421	10.252579	9.828783	10.171217	10.081362	9.918638	45	3
58	30	9.747468	10.252532	9.828851	10.171149	10.081383	9.918617	30	2
59	45	9.747515	10.252485	9.828919	10.171081	10.081405	9.918595	15	1
60	60	9.747562	10.252438	9.828987	10.171013	10.081426	9.918574	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 44 ^m		LOG. SINES, &c.						56 deg.	

2 ^h 16 ^m .		LOG. SINES, &c. (t.)						34 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.747562	10.252438	9.828987	10.171013	10.081426	9.918574	60	60
1	15	9.747608	10.252392	9.829056	10.170944	10.081447	9.918553	45	59
2	30	9.747655	10.252345	9.829124	10.170876	10.081468	9.918532	30	58
3	45	9.747702	10.252298	9.829192	10.170808	10.081490	9.918510	15	57
4	1	9.747749	10.252251	9.829260	10.170740	10.081511	9.918489	59	56
5	15	9.747796	10.252204	9.829328	10.170672	10.081532	9.918468	45	55
6	30	9.747842	10.252158	9.829396	10.170604	10.081554	9.918446	30	54
7	45	9.747889	10.252111	9.829464	10.170536	10.081575	9.918425	15	53
8	2	9.747936	10.252064	9.829532	10.170468	10.081596	9.918404	58	52
9	15	9.747983	10.252017	9.829600	10.170400	10.081618	9.918382	45	51
10	30	9.748029	10.251971	9.829668	10.170332	10.081639	9.918361	30	50
11	45	9.748076	10.251924	9.829737	10.170263	10.081660	9.918340	15	49
12	3	9.748123	10.251877	9.829805	10.170195	10.081682	9.918318	57	48
13	15	9.748170	10.251830	9.829873	10.170127	10.081703	9.918297	45	47
14	30	9.748216	10.251784	9.829941	10.170059	10.081724	9.918276	30	46
15	45	9.748263	10.251737	9.830009	10.169991	10.081746	9.918254	15	45
16	4	9.748310	10.251690	9.830077	10.169923	10.081767	9.918233	56	44
17	15	9.748357	10.251643	9.830145	10.169855	10.081788	9.918212	45	43
18	30	9.748403	10.251597	9.830213	10.169787	10.081810	9.918190	30	42
19	45	9.748450	10.251550	9.830281	10.169719	10.081831	9.918169	15	41
20	5	9.748497	10.251503	9.830349	10.169651	10.081853	9.918147	55	40
21	15	9.748543	10.251457	9.830417	10.169583	10.081874	9.918126	45	39
22	30	9.748590	10.251410	9.830485	10.169515	10.081895	9.918105	30	38
23	45	9.748637	10.251363	9.830553	10.169447	10.081917	9.918083	15	37
24	6	9.748683	10.251317	9.830621	10.169379	10.081938	9.918062	54	36
25	15	9.748730	10.251270	9.830689	10.169311	10.081959	9.918041	45	35
26	30	9.748777	10.251223	9.830757	10.169243	10.081981	9.918019	30	34
27	45	9.748823	10.251177	9.830825	10.169175	10.082002	9.917998	15	33
28	7	9.748870	10.251130	9.830893	10.169107	10.082024	9.917976	53	32
29	15	9.748916	10.251084	9.830961	10.169039	10.082045	9.917955	45	31
30	30	9.748963	10.251037	9.831029	10.168971	10.082066	9.917934	30	30
31	45	9.749010	10.250990	9.831097	10.168903	10.082088	9.917912	15	29
32	8	9.749056	10.250944	9.831165	10.168835	10.082109	9.917891	52	28
33	15	9.749103	10.250897	9.831233	10.168767	10.082131	9.917869	45	27
34	30	9.749149	10.250851	9.831301	10.168699	10.082152	9.917848	30	26
35	45	9.749196	10.250804	9.831369	10.168631	10.082173	9.917827	15	25
36	9	9.749242	10.250758	9.831437	10.168563	10.082195	9.917805	51	24
37	15	9.749289	10.250711	9.831505	10.168495	10.082216	9.917784	45	23
38	30	9.749336	10.250664	9.831573	10.168427	10.082238	9.917762	30	22
39	45	9.749382	10.250618	9.831641	10.168359	10.082259	9.917741	15	21
40	10	9.749429	10.250571	9.831709	10.168291	10.082281	9.917719	50	20
41	15	9.749475	10.250525	9.831777	10.168223	10.082302	9.917698	45	19
42	30	9.749522	10.250478	9.831845	10.168155	10.082324	9.917676	30	18
43	45	9.749568	10.250432	9.831913	10.168087	10.082345	9.917655	15	17
44	11	9.749615	10.250385	9.831981	10.168019	10.082366	9.917634	49	16
45	15	9.749661	10.250339	9.832049	10.167951	10.082388	9.917612	45	15
46	30	9.749708	10.250292	9.832117	10.167883	10.082409	9.917591	30	14
47	45	9.749754	10.250246	9.832185	10.167815	10.082431	9.917569	15	13
48	12	9.749801	10.250199	9.832253	10.167747	10.082452	9.917548	48	12
49	15	9.749847	10.250153	9.832321	10.167679	10.082474	9.917526	45	11
50	30	9.749894	10.250106	9.832389	10.167611	10.082495	9.917505	30	10
51	45	9.749940	10.250060	9.832457	10.167543	10.082517	9.917483	15	9
52	13	9.749987	10.250013	9.832525	10.167475	10.082538	9.917462	47	8
53	15	9.750033	10.249967	9.832593	10.167407	10.082560	9.917440	45	7
54	30	9.750079	10.249921	9.832660	10.167340	10.082581	9.917419	30	6
55	45	9.750126	10.249874	9.832728	10.167272	10.082603	9.917397	15	5
56	14	9.750172	10.249828	9.832796	10.167204	10.082624	9.917376	46	4
57	15	9.750219	10.249781	9.832864	10.167136	10.082646	9.917354	45	3
58	30	9.750265	10.249735	9.832932	10.167068	10.082667	9.917333	30	2
59	45	9.750311	10.249689	9.833000	10.167000	10.082689	9.917311	15	1
60	15	9.750358	10.249642	9.833068	10.166932	10.082710	9.917290	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 43 ^m .		LOG. SINES, &c.						55 deg.	

2 ^h 17 ^m .			LOG. SINES, &c. (t.)				34 deg.		
sec.	"	sine.	cosecant	tangent.	cotangent.	secant.	cosine.		sec.
0	15	9.750358	10.249642	9.833068	10.166932	10.082710	9.917290	45	60
1	15	9.750404	10.249596	9.833136	10.166864	10.082732	9.917268	45	59
2	30	9.750451	10.249549	9.833204	10.166796	10.082753	9.917247	30	58
3	45	9.750497	10.249503	9.833271	10.166729	10.082775	9.917225	15	57
4	16	9.750543	10.249457	9.833339	10.166661	10.082796	9.917204	44	56
5	15	9.750590	10.249410	9.833407	10.166593	10.082818	9.917182	45	55
6	30	9.750636	10.249364	9.833475	10.166525	10.082839	9.917161	30	54
7	45	9.750682	10.249318	9.833543	10.166457	10.082861	9.917139	15	53
8	17	9.750729	10.249271	9.833611	10.166389	10.082882	9.917118	43	52
9	15	9.750775	10.249225	9.833679	10.166321	10.082904	9.917096	45	51
10	30	9.750821	10.249179	9.833747	10.166253	10.082925	9.917075	30	50
11	45	9.750868	10.249132	9.833814	10.166186	10.082947	9.917053	15	49
12	18	9.750914	10.249086	9.833882	10.166118	10.082968	9.917032	42	48
13	15	9.750960	10.249040	9.833950	10.166050	10.082990	9.917010	45	47
14	30	9.751007	10.248993	9.834018	10.165982	10.083011	9.916989	30	46
15	45	9.751053	10.248947	9.834086	10.165914	10.083033	9.916967	15	45
16	19	9.751099	10.248901	9.834154	10.165846	10.083055	9.916945	41	44
17	15	9.751145	10.248855	9.834221	10.165779	10.083076	9.916924	45	43
18	30	9.751192	10.248808	9.834289	10.165711	10.083098	9.916902	30	42
19	45	9.751238	10.248762	9.834357	10.165643	10.083119	9.916881	15	41
20	20	9.751284	10.248716	9.834425	10.165575	10.083141	9.916859	40	40
21	15	9.751330	10.248670	9.834493	10.165507	10.083162	9.916838	45	39
22	30	9.751377	10.248623	9.834560	10.165440	10.083184	9.916816	30	38
23	45	9.751423	10.248577	9.834628	10.165372	10.083206	9.916794	15	37
24	21	9.751469	10.248531	9.834696	10.165304	10.083227	9.916773	39	36
25	15	9.751515	10.248485	9.834764	10.165236	10.083249	9.916751	45	35
26	30	9.751561	10.248439	9.834832	10.165168	10.083270	9.916730	30	34
27	45	9.751608	10.248392	9.834899	10.165101	10.083292	9.916708	15	33
28	22	9.751654	10.248346	9.834967	10.165033	10.083313	9.916687	38	32
29	15	9.751700	10.248300	9.835035	10.164965	10.083335	9.916665	45	31
30	30	9.751746	10.248254	9.835103	10.164897	10.083357	9.916643	30	30
31	45	9.751792	10.248208	9.835171	10.164829	10.083378	9.916622	15	29
32	23	9.751838	10.248162	9.835238	10.164762	10.083400	9.916600	37	28
33	15	9.751885	10.248115	9.835306	10.164694	10.083421	9.916579	45	27
34	30	9.751931	10.248069	9.835374	10.164626	10.083443	9.916557	30	26
35	45	9.751977	10.248023	9.835442	10.164558	10.083465	9.916535	15	25
36	24	9.752023	10.247977	9.835509	10.164491	10.083486	9.916514	36	24
37	15	9.752069	10.247931	9.835577	10.164423	10.083508	9.916492	45	23
38	30	9.752115	10.247885	9.835645	10.164355	10.083530	9.916470	30	22
39	45	9.752161	10.247839	9.835713	10.164287	10.083551	9.916449	15	21
40	25	9.752207	10.247793	9.835780	10.164220	10.083573	9.916427	35	20
41	15	9.752254	10.247746	9.835848	10.164152	10.083595	9.916405	45	19
42	30	9.752300	10.247700	9.835916	10.164084	10.083616	9.916384	30	18
43	45	9.752346	10.247654	9.835984	10.164016	10.083638	9.916362	15	17
44	26	9.752392	10.247608	9.836051	10.163949	10.083659	9.916341	34	16
45	15	9.752438	10.247562	9.836119	10.163881	10.083681	9.916319	45	15
46	30	9.752484	10.247516	9.836187	10.163813	10.083703	9.916297	30	14
47	45	9.752530	10.247470	9.836254	10.163746	10.083724	9.916276	15	13
48	27	9.752576	10.247424	9.836322	10.163678	10.083746	9.916254	33	12
49	15	9.752622	10.247378	9.836390	10.163610	10.083768	9.916232	45	11
50	30	9.752668	10.247332	9.836457	10.163543	10.083789	9.916211	30	10
51	45	9.752714	10.247286	9.836525	10.163475	10.083811	9.916189	15	9
52	28	9.752760	10.247240	9.836593	10.163407	10.083833	9.916167	32	8
53	15	9.752806	10.247194	9.836661	10.163339	10.083854	9.916146	45	7
54	30	9.752852	10.247148	9.836728	10.163272	10.083876	9.916124	30	6
55	45	9.752898	10.247102	9.836796	10.163204	10.083898	9.916102	15	5
56	29	9.752944	10.247056	9.836864	10.163136	10.083920	9.916080	31	4
57	15	9.752990	10.247010	9.836931	10.163069	10.083941	9.916059	45	3
58	30	9.753036	10.246964	9.836999	10.163001	10.083963	9.916037	30	2
59	45	9.753082	10.246918	9.837067	10.162933	10.083985	9.916015	15	1
60	30	9.753128	10.246872	9.837134	10.162866	10.084006	9.915994	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 42 ^m .			LOG. SINES, &c.				55 deg.		

2 ^h 18 ^m		LOG. SINES, &c. (t.)						34 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.753128	10.246872	9.837134	10.162866	10.084006	9.915994	30	60
1	15	9.753174	10.246826	9.837202	10.162798	10.084028	9.915972	45	59
2	30	9.753220	10.246780	9.837270	10.162730	10.084050	9.915950	30	58
3	45	9.753266	10.246734	9.837337	10.162663	10.084071	9.915929	15	57
4	31	9.753312	10.246688	9.837405	10.162595	10.084093	9.915907	29	56
5	15	9.753358	10.246642	9.837473	10.162527	10.084115	9.915885	45	55
6	30	9.753404	10.246596	9.837540	10.162460	10.084137	9.915863	30	54
7	45	9.753449	10.246551	9.837608	10.162392	10.084158	9.915842	15	53
8	32	9.753495	10.246505	9.837675	10.162325	10.084180	9.915820	28	52
9	15	9.753541	10.246459	9.837743	10.162257	10.084202	9.915798	45	51
10	30	9.753587	10.246413	9.837811	10.162189	10.084224	9.915776	30	50
11	45	9.753633	10.246367	9.837878	10.162122	10.084245	9.915755	15	49
12	33	9.753679	10.246321	9.837946	10.162054	10.084267	9.915733	27	48
13	15	9.753725	10.246275	9.838014	10.161986	10.084289	9.915711	45	47
14	30	9.753771	10.246229	9.838081	10.161919	10.084311	9.915689	30	46
15	45	9.753816	10.246184	9.838149	10.161851	10.084332	9.915668	15	45
16	34	9.753862	10.246138	9.838216	10.161784	10.084354	9.915646	26	44
17	15	9.753908	10.246092	9.838284	10.161716	10.084376	9.915624	45	43
18	30	9.753954	10.246046	9.838352	10.161648	10.084398	9.915602	30	42
19	45	9.754000	10.246000	9.838419	10.161581	10.084419	9.915581	15	41
20	35	9.754046	10.245954	9.838487	10.161513	10.084441	9.915559	25	40
21	15	9.754091	10.245909	9.838554	10.161446	10.084463	9.915537	45	39
22	30	9.754137	10.245863	9.838622	10.161378	10.084485	9.915515	30	38
23	45	9.754183	10.245817	9.838689	10.161311	10.084506	9.915494	15	37
24	36	9.754229	10.245771	9.838757	10.161243	10.084528	9.915472	24	36
25	15	9.754275	10.245725	9.838825	10.161175	10.084550	9.915450	45	35
26	30	9.754320	10.245680	9.838892	10.161108	10.084572	9.915428	30	34
27	45	9.754366	10.245634	9.838960	10.161040	10.084594	9.915406	15	33
28	37	9.754412	10.245588	9.839027	10.160973	10.084615	9.915385	23	32
29	15	9.754458	10.245542	9.839095	10.160905	10.084637	9.915363	45	31
30	30	9.754503	10.245497	9.839162	10.160838	10.084659	9.915341	30	30
31	45	9.754549	10.245451	9.839230	10.160770	10.084681	9.915319	15	29
32	38	9.754595	10.245405	9.839297	10.160703	10.084703	9.915297	22	28
33	15	9.754641	10.245359	9.839365	10.160635	10.084724	9.915276	45	27
34	30	9.754686	10.245314	9.839433	10.160567	10.084746	9.915254	30	26
35	45	9.754732	10.245268	9.839500	10.160500	10.084768	9.915232	15	25
36	39	9.754778	10.245222	9.839568	10.160432	10.084790	9.915210	21	24
37	15	9.754823	10.245177	9.839635	10.160365	10.084812	9.915188	45	23
38	30	9.754869	10.245131	9.839703	10.160297	10.084834	9.915166	30	22
39	45	9.754915	10.245085	9.839770	10.160230	10.084855	9.915145	15	21
40	40	9.754960	10.245040	9.839838	10.160162	10.084877	9.915123	20	20
41	15	9.755006	10.244994	9.839905	10.160095	10.084899	9.915101	45	19
42	30	9.755052	10.244948	9.839973	10.160027	10.084921	9.915079	30	18
43	45	9.755097	10.244903	9.840040	10.159960	10.084943	9.915057	15	17
44	41	9.755143	10.244857	9.840108	10.159892	10.084965	9.915035	19	16
45	15	9.755189	10.244811	9.840175	10.159825	10.084987	9.915013	45	15
46	30	9.755234	10.244766	9.840243	10.159757	10.085008	9.914992	30	14
47	45	9.755280	10.244720	9.840310	10.159690	10.085030	9.914970	15	13
48	42	9.755326	10.244674	9.840378	10.159622	10.085052	9.914948	18	12
49	15	9.755371	10.244629	9.840445	10.159555	10.085074	9.914926	45	11
50	30	9.755417	10.244583	9.840513	10.159487	10.085096	9.914904	30	10
51	45	9.755462	10.244538	9.840580	10.159420	10.085118	9.914882	15	9
52	43	9.755508	10.244492	9.840647	10.159353	10.085140	9.914860	17	8
53	15	9.755553	10.244447	9.840715	10.159285	10.085162	9.914838	45	7
54	30	9.755599	10.244401	9.840782	10.159218	10.085183	9.914817	30	6
55	45	9.755645	10.244355	9.840850	10.159150	10.085205	9.914795	15	5
56	44	9.755690	10.244310	9.840917	10.159083	10.085227	9.914773	16	4
57	15	9.755736	10.244264	9.840985	10.159015	10.085249	9.914751	45	3
58	30	9.755781	10.244219	9.841052	10.158948	10.085271	9.914729	30	2
59	45	9.755827	10.244173	9.841120	10.158880	10.085293	9.914707	15	1
60	45	9.755872	10.244128	9.841187	10.158813	10.085315	9.914685	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 41 ^m .		LOG. SINES, &c.						55 deg.	

2 ^h 19 ^m .			LOG. SINES, &c. (t.)						34 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0	45		9.755872	10.244128	9.841187	10.158813	10.085315	9.914685	15		60
1		15	9.755918	10.244082	9.841255	10.158745	10.085337	9.914663	45		59
2		30	9.755963	10.244037	9.841322	10.158678	10.085359	9.914641	30		58
3		45	9.756009	10.243991	9.841389	10.158611	10.085381	9.914619	15		57
4	46		9.756054	10.243946	9.841457	10.158543	10.085402	9.914598	14		56
5		15	9.756100	10.243900	9.841524	10.158476	10.085424	9.914576	45		55
6		30	9.756145	10.243855	9.841592	10.158408	10.085446	9.914554	30		54
7		45	9.756191	10.243809	9.841659	10.158341	10.085468	9.914532	15		53
8	47		9.756236	10.243764	9.841726	10.158274	10.085490	9.914510	13		52
9		15	9.756282	10.243718	9.841794	10.158206	10.085512	9.914488	45		51
10		30	9.756327	10.243673	9.841861	10.158139	10.085534	9.914466	30		50
11		45	9.756373	10.243627	9.841929	10.158071	10.085556	9.914444	15		49
12	48		9.756418	10.243582	9.841996	10.158004	10.085578	9.914422	12		48
13		15	9.756464	10.243536	9.842063	10.157937	10.085600	9.914400	45		47
14		30	9.756509	10.243491	9.842131	10.157869	10.085622	9.914378	30		46
15		45	9.756554	10.243446	9.842198	10.157802	10.085644	9.914356	15		45
16	49		9.756600	10.243400	9.842266	10.157734	10.085666	9.914334	11		44
17		15	9.756645	10.243355	9.842333	10.157667	10.085688	9.914312	45		43
18		30	9.756691	10.243309	9.842400	10.157600	10.085710	9.914290	30		42
19		45	9.756736	10.243264	9.842468	10.157532	10.085732	9.914268	15		41
20	50		9.756781	10.243219	9.842535	10.157465	10.085754	9.914246	10		40
21		15	9.756827	10.243173	9.842602	10.157398	10.085776	9.914224	45		39
22		30	9.756872	10.243128	9.842670	10.157330	10.085798	9.914202	30		38
23		45	9.756918	10.243082	9.842737	10.157263	10.085820	9.914180	15		37
24	51		9.756963	10.243037	9.842805	10.157195	10.085842	9.914158	9		36
25		15	9.757008	10.242992	9.842872	10.157128	10.085864	9.914136	45		35
26		30	9.757054	10.242946	9.842939	10.157061	10.085886	9.914114	30		34
27		45	9.757099	10.242901	9.843007	10.156993	10.085908	9.914092	15		33
28	52		9.757144	10.242856	9.843074	10.156926	10.085930	9.914070	8		32
29		15	9.757190	10.242810	9.843141	10.156859	10.085952	9.914048	45		31
30		30	9.757235	10.242765	9.843209	10.156791	10.085974	9.914026	30		30
31		45	9.757280	10.242720	9.843276	10.156724	10.085996	9.914004	15		29
32	53		9.757326	10.242674	9.843343	10.156657	10.086018	9.913982	7		28
33		15	9.757371	10.242629	9.843411	10.156589	10.086040	9.913960	45		27
34		30	9.757416	10.242584	9.843478	10.156522	10.086062	9.913938	30		26
35		45	9.757461	10.242539	9.843545	10.156455	10.086084	9.913916	15		25
36	54		9.757507	10.242493	9.843612	10.156388	10.086106	9.913894	6		24
37		15	9.757552	10.242448	9.843680	10.156320	10.086128	9.913872	45		23
38		30	9.757597	10.242403	9.843747	10.156253	10.086150	9.913850	30		22
39		45	9.757643	10.242357	9.843814	10.156186	10.086172	9.913828	15		21
40	55		9.757688	10.242312	9.843882	10.156118	10.086194	9.913806	5		20
41		15	9.757733	10.242267	9.843949	10.156051	10.086216	9.913784	45		19
42		30	9.757778	10.242222	9.844016	10.155984	10.086238	9.913762	30		18
43		45	9.757823	10.242177	9.844083	10.155917	10.086260	9.913740	15		17
44	56		9.757869	10.242131	9.844151	10.155849	10.086282	9.913718	4		16
45		15	9.757914	10.242086	9.844218	10.155782	10.086304	9.913696	45		15
46		30	9.757959	10.242041	9.844285	10.155715	10.086326	9.913674	30		14
47		45	9.758004	10.241996	9.844353	10.155647	10.086348	9.913652	15		13
48	57		9.758049	10.241951	9.844420	10.155580	10.086370	9.913630	3		12
49		15	9.758095	10.241905	9.844487	10.155513	10.086392	9.913608	45		11
50		30	9.758140	10.241860	9.844554	10.155446	10.086415	9.913585	30		10
51		45	9.758185	10.241815	9.844622	10.155378	10.086437	9.913563	15		9
52	58		9.758230	10.241770	9.844689	10.155311	10.086459	9.913541	2		8
53		15	9.758275	10.241725	9.844756	10.155244	10.086481	9.913519	45		7
54		30	9.758320	10.241680	9.844822	10.155177	10.086503	9.913497	30		6
55		45	9.758366	10.241634	9.844891	10.155109	10.086525	9.913475	15		5
56	59		9.758411	10.241589	9.844958	10.155042	10.086547	9.913453	1		4
57		15	9.758456	10.241544	9.845025	10.154975	10.086569	9.913431	45		3
58		30	9.758501	10.241499	9.845092	10.154908	10.086591	9.913409	30		2
59		45	9.758546	10.241454	9.845160	10.154840	10.086613	9.913387	15		1
60	60		9.758591	10.241409	9.845227	10.154773	10.086636	9.913364	0		0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.
3 ^h 40 ^m .			LOG. SINES, &c.						55 deg.		

2 ^h 20 ^m .			LOG. SINES, &c. (t.)					35 deg		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	0	9.758591	10.241409	9.845227	10.154773	10.086636	9.913364	60	60	
1	15	9.758636	10.241364	9.845294	10.154706	10.086658	9.913342	45	59	
2	30	9.758681	10.241319	9.845361	10.154639	10.086680	9.913320	30	58	
3	45	9.758727	10.241273	9.845428	10.154572	10.086702	9.913298	15	57	
4	1	9.758772	10.241228	9.845496	10.154504	10.086724	9.913276	59	56	
5	15	9.758817	10.241183	9.845563	10.154437	10.086746	9.913254	45	55	
6	30	9.758862	10.241138	9.845630	10.154370	10.086768	9.913232	30	54	
7	45	9.758907	10.241093	9.845697	10.154303	10.086790	9.913210	15	53	
8	2	9.758952	10.241048	9.845764	10.154236	10.086813	9.913187	58	52	
9	15	9.758997	10.241003	9.845832	10.154168	10.086835	9.913165	45	51	
10	30	9.759042	10.240958	9.845899	10.154101	10.086857	9.913143	30	50	
11	45	9.759087	10.240913	9.845966	10.154034	10.086879	9.913121	15	49	
12	3	9.759132	10.240868	9.846033	10.153967	10.086901	9.913099	57	48	
13	15	9.759177	10.240823	9.846100	10.153900	10.086923	9.913077	45	47	
14	30	9.759222	10.240778	9.846167	10.153833	10.086945	9.913055	30	46	
15	45	9.759267	10.240733	9.846235	10.153765	10.086968	9.913032	15	45	
16	4	9.759312	10.240688	9.846302	10.153698	10.086990	9.913010	56	44	
17	15	9.759357	10.240643	9.846369	10.153631	10.087012	9.912988	45	43	
18	30	9.759402	10.240598	9.846436	10.153564	10.087034	9.912966	30	42	
19	45	9.759447	10.240553	9.846503	10.153497	10.087056	9.912944	15	41	
20	5	9.759492	10.240508	9.846570	10.153430	10.087079	9.912921	55	40	
21	15	9.759537	10.240463	9.846638	10.153362	10.087101	9.912899	45	39	
22	30	9.759582	10.240418	9.846705	10.153295	10.087123	9.912877	30	38	
23	45	9.759627	10.240373	9.846772	10.153228	10.087145	9.912855	15	37	
24	6	9.759672	10.240328	9.846839	10.153161	10.087167	9.912833	54	36	
25	15	9.759717	10.240283	9.846906	10.153094	10.087189	9.912811	45	35	
26	30	9.759762	10.240238	9.846973	10.153027	10.087212	9.912788	30	34	
27	45	9.759807	10.240193	9.847040	10.152960	10.087234	9.912766	15	33	
28	7	9.759851	10.240149	9.847107	10.152893	10.087256	9.912744	53	32	
29	15	9.759896	10.240104	9.847175	10.152825	10.087278	9.912722	45	31	
30	30	9.759941	10.240059	9.847242	10.152758	10.087301	9.912699	30	30	
31	45	9.759986	10.240014	9.847309	10.152691	10.087323	9.912677	15	29	
32	8	9.760031	10.239969	9.847376	10.152624	10.087345	9.912655	52	28	
33	15	9.760076	10.239924	9.847443	10.152557	10.087367	9.912633	45	27	
34	30	9.760121	10.239879	9.847510	10.152490	10.087389	9.912611	30	26	
35	45	9.760166	10.239834	9.847577	10.152423	10.087412	9.912588	15	25	
36	9	9.760211	10.239789	9.847644	10.152356	10.087434	9.912566	51	24	
37	15	9.760255	10.239745	9.847711	10.152289	10.087456	9.912544	45	23	
38	30	9.760300	10.239700	9.847779	10.152221	10.087478	9.912522	30	22	
39	45	9.760345	10.239655	9.847846	10.152154	10.087501	9.912499	15	21	
40	10	9.760390	10.239610	9.847913	10.152087	10.087523	9.912477	50	20	
41	15	9.760435	10.239565	9.847980	10.152020	10.087545	9.912455	45	19	
42	30	9.760480	10.239520	9.848047	10.151953	10.087567	9.912433	30	18	
43	45	9.760524	10.239476	9.848114	10.151886	10.087590	9.912410	15	17	
44	11	9.760569	10.239431	9.848181	10.151819	10.087612	9.912388	49	16	
45	15	9.760614	10.239386	9.848248	10.151752	10.087634	9.912366	45	15	
46	30	9.760659	10.239341	9.848315	10.151685	10.087656	9.912344	30	14	
47	45	9.760703	10.239297	9.848382	10.151618	10.087679	9.912321	15	13	
48	12	9.760748	10.239252	9.848449	10.151551	10.087701	9.912299	48	12	
49	15	9.760793	10.239207	9.848516	10.151484	10.087723	9.912277	45	11	
50	30	9.760838	10.239162	9.848583	10.151417	10.087746	9.912254	30	10	
51	45	9.760883	10.239117	9.848650	10.151350	10.087768	9.912232	15	9	
52	13	9.760927	10.239073	9.848717	10.151283	10.087790	9.912210	47	8	
53	15	9.760972	10.239028	9.848784	10.151216	10.087812	9.912188	45	7	
54	30	9.761017	10.238983	9.848851	10.151149	10.087835	9.912165	30	6	
55	45	9.761062	10.238938	9.848918	10.151082	10.087857	9.912143	15	5	
56	14	9.761106	10.238894	9.848985	10.151015	10.087879	9.912121	46	4	
57	15	9.761151	10.238849	9.849053	10.150947	10.087902	9.912098	45	3	
58	30	9.761196	10.238804	9.849120	10.150880	10.087924	9.912076	30	2	
59	45	9.761240	10.238760	9.849187	10.150813	10.087946	9.912054	15	1	
60	15	9.761285	10.238715	9.849254	10.150746	10.087969	9.912031	45	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
3 ^h 39 ^m .			LOG. SINES, &c.					54 deg		

2 ^h 21 ^m .		LOG. SINES, &c. (t.)						35 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.761285	10.238715	9.849254	10.150746	10.087969	9.912031	45	60
1	15	9.761330	10.238670	9.849321	10.150679	10.087991	9.912009	45	59
2	30	9.761374	10.238626	9.849388	10.150612	10.088013	9.911987	30	58
3	45	9.761419	10.238581	9.849455	10.150545	10.088036	9.911964	15	57
4	16	9.761464	10.238536	9.849522	10.150478	10.088058	9.911942	44	56
5	15	9.761508	10.238492	9.849589	10.150411	10.088080	9.911920	45	55
6	30	9.761553	10.238447	9.849656	10.150344	10.088103	9.911897	30	54
7	45	9.761598	10.238402	9.849723	10.150277	10.088125	9.911875	15	53
8	17	9.761642	10.238358	9.849790	10.150210	10.088147	9.911853	43	52
9	15	9.761687	10.238313	9.849856	10.150144	10.088170	9.911830	45	51
10	30	9.761732	10.238268	9.849923	10.150077	10.088192	9.911808	30	50
11	45	9.761776	10.238224	9.849990	10.150010	10.088214	9.911786	15	49
12	18	9.761821	10.238179	9.850057	10.149943	10.088237	9.911763	42	48
13	15	9.761865	10.238135	9.850124	10.149876	10.088259	9.911741	45	47
14	30	9.761910	10.238090	9.850191	10.149809	10.088281	9.911719	30	46
15	45	9.761955	10.238045	9.850258	10.149742	10.088304	9.911696	15	45
16	19	9.761999	10.238001	9.850325	10.149675	10.088326	9.911674	41	44
17	15	9.762044	10.237956	9.850392	10.149608	10.088349	9.911651	45	43
18	30	9.762088	10.237912	9.850459	10.149541	10.088371	9.911629	30	42
19	45	9.762133	10.237867	9.850526	10.149474	10.088393	9.911607	15	41
20	20	9.762177	10.237823	9.850593	10.149407	10.088416	9.911584	40	40
21	15	9.762222	10.237778	9.850660	10.149340	10.088438	9.911562	45	39
22	30	9.762267	10.237733	9.850727	10.149273	10.088460	9.911540	30	38
23	45	9.762311	10.237689	9.850794	10.149206	10.088483	9.911517	15	37
24	21	9.762356	10.237644	9.850861	10.149139	10.088505	9.911495	39	36
25	15	9.762400	10.237600	9.850928	10.149072	10.088528	9.911472	45	35
26	30	9.762445	10.237555	9.850995	10.149005	10.088550	9.911450	30	34
27	45	9.762489	10.237511	9.851062	10.148938	10.088572	9.911428	15	33
28	22	9.762534	10.237466	9.851128	10.148872	10.088595	9.911405	38	32
29	15	9.762578	10.237422	9.851195	10.148805	10.088617	9.911383	45	31
30	30	9.762623	10.237377	9.851262	10.148738	10.088640	9.911360	30	30
31	45	9.762667	10.237333	9.851329	10.148671	10.088662	9.911338	15	29
32	23	9.762712	10.237288	9.851396	10.148604	10.088685	9.911315	37	28
33	15	9.762756	10.237244	9.851463	10.148537	10.088707	9.911293	45	27
34	30	9.762800	10.237200	9.851530	10.148470	10.088729	9.911271	30	26
35	45	9.762845	10.237155	9.851597	10.148403	10.088752	9.911248	15	25
36	24	9.762889	10.237111	9.851664	10.148336	10.088774	9.911226	36	24
37	15	9.762934	10.237066	9.851731	10.148269	10.088797	9.911203	45	23
38	30	9.762978	10.237022	9.851797	10.148203	10.088819	9.911181	30	22
39	45	9.763023	10.236977	9.851864	10.148136	10.088842	9.911158	15	21
40	25	9.763067	10.236933	9.851931	10.148069	10.088864	9.911136	35	20
41	15	9.763111	10.236889	9.851998	10.148002	10.088887	9.911113	45	19
42	30	9.763156	10.236844	9.852065	10.147935	10.088909	9.911091	30	18
43	45	9.763200	10.236800	9.852132	10.147868	10.088932	9.911068	15	17
44	26	9.763245	10.236755	9.852199	10.147801	10.088954	9.911046	34	16
45	15	9.763289	10.236711	9.852265	10.147735	10.088976	9.911024	45	15
46	30	9.763333	10.236667	9.852332	10.147668	10.088999	9.911001	30	14
47	45	9.763378	10.236622	9.852399	10.147601	10.089021	9.910979	15	13
48	27	9.763422	10.236578	9.852466	10.147534	10.089044	9.910956	33	12
49	15	9.763467	10.236533	9.852533	10.147467	10.089066	9.910934	45	11
50	30	9.763511	10.236489	9.852600	10.147400	10.089089	9.910911	30	10
51	45	9.763555	10.236445	9.852667	10.147333	10.089111	9.910889	15	9
52	28	9.763600	10.236400	9.852733	10.147267	10.089134	9.910866	32	8
53	15	9.763644	10.236356	9.852800	10.147200	10.089156	9.910844	45	7
54	30	9.763688	10.236312	9.852867	10.147133	10.089179	9.910821	30	6
55	45	9.763733	10.236267	9.852934	10.147066	10.089201	9.910799	15	5
56	29	9.763777	10.236223	9.853001	10.146999	10.089224	9.910776	31	4
57	15	9.763821	10.236179	9.853068	10.146932	10.089246	9.910754	45	3
58	30	9.763865	10.236135	9.853134	10.146866	10.089269	9.910731	30	2
59	45	9.763910	10.236090	9.853201	10.146800	10.089291	9.910709	15	1
60	30	9.763954	10.236046	9.853268	10.146732	10.089314	9.910686	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 38 ^m .		LOG. SINES, &c.						54 deg.	

2 ^h 22 ^m .		LOG. SINES, &c. (t.)						35 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.763954	10.236046	9.853268	10.146732	10.089314	9.910686	30	60
1	15	9.763998	10.236002	9.853335	10.146665	10.089337	9.910663	45	59
2	30	9.764043	10.235957	9.853402	10.146598	10.089359	9.910641	30	58
3	45	9.764087	10.235913	9.853468	10.146532	10.089382	9.910618	15	57
4	31	9.764131	10.235869	9.853535	10.146465	10.089404	9.910596	29	56
5	15	9.764175	10.235825	9.853602	10.146398	10.089427	9.910573	45	55
6	30	9.764220	10.235780	9.853669	10.146331	10.089449	9.910551	30	54
7	45	9.764264	10.235736	9.853736	10.146264	10.089472	9.910528	15	53
8	32	9.764308	10.235692	9.853802	10.146198	10.089494	9.910506	28	52
9	15	9.764352	10.235648	9.853869	10.146131	10.089517	9.910483	45	51
10	30	9.764396	10.235604	9.853936	10.146064	10.089539	9.910461	30	50
11	45	9.764441	10.235559	9.854003	10.145997	10.089562	9.910438	15	49
12	33	9.764485	10.235515	9.854069	10.145931	10.089585	9.910415	27	48
13	15	9.764529	10.235471	9.854136	10.145864	10.089607	9.910393	45	47
14	30	9.764573	10.235427	9.854203	10.145797	10.089630	9.910370	30	46
15	45	9.764617	10.235383	9.854270	10.145730	10.089652	9.910348	15	45
16	34	9.764662	10.235338	9.854336	10.145664	10.089675	9.910325	26	44
17	15	9.764706	10.235294	9.854403	10.145597	10.089697	9.910303	45	43
18	30	9.764750	10.235250	9.854470	10.145530	10.089720	9.910280	30	42
19	45	9.764794	10.235206	9.854537	10.145463	10.089743	9.910257	15	41
20	35	9.764838	10.235162	9.854603	10.145397	10.089765	9.910235	25	40
21	15	9.764882	10.235118	9.854670	10.145330	10.089788	9.910212	45	39
22	30	9.764926	10.235074	9.854737	10.145263	10.089810	9.910190	30	38
23	45	9.764971	10.235029	9.854804	10.145196	10.089833	9.910167	15	37
24	36	9.765015	10.234985	9.854870	10.145130	10.089856	9.910144	24	36
25	15	9.765059	10.234941	9.854937	10.145063	10.089878	9.910122	45	35
26	30	9.765103	10.234897	9.855004	10.144996	10.089901	9.910099	30	34
27	45	9.765147	10.234853	9.855070	10.144930	10.089924	9.910076	15	33
28	37	9.765191	10.234809	9.855137	10.144863	10.089946	9.910054	23	32
29	15	9.765235	10.234765	9.855204	10.144796	10.089969	9.910031	45	31
30	30	9.765279	10.234721	9.855271	10.144729	10.089991	9.910009	30	30
31	45	9.765323	10.234677	9.855337	10.144663	10.090014	9.909986	15	29
32	38	9.765367	10.234633	9.855404	10.144596	10.090037	9.909963	22	28
33	15	9.765411	10.234589	9.855471	10.144529	10.090059	9.909941	45	27
34	30	9.765455	10.234545	9.855537	10.144463	10.090082	9.909918	30	26
35	45	9.765500	10.234500	9.855604	10.144396	10.090105	9.909895	15	25
36	39	9.765544	10.234456	9.855671	10.144329	10.090127	9.909873	21	24
37	15	9.765588	10.234412	9.855737	10.144263	10.090150	9.909850	45	23
38	30	9.765632	10.234368	9.855804	10.144196	10.090173	9.909827	30	22
39	45	9.765676	10.234324	9.855871	10.144129	10.090195	9.909805	15	21
40	40	9.765720	10.234280	9.855938	10.144062	10.090218	9.909782	20	20
41	15	9.765764	10.234236	9.856004	10.143996	10.090241	9.909759	45	19
42	30	9.765808	10.234192	9.856071	10.143929	10.090263	9.909737	30	18
43	45	9.765852	10.234148	9.856138	10.143862	10.090286	9.909714	15	17
44	41	9.765896	10.234104	9.856204	10.143796	10.090309	9.909691	19	16
45	15	9.765940	10.234060	9.856271	10.143729	10.090331	9.909669	45	15
46	30	9.765984	10.234016	9.856337	10.143663	10.090354	9.909646	30	14
47	45	9.766028	10.233972	9.856404	10.143596	10.090377	9.909623	15	13
48	42	9.766071	10.233929	9.856471	10.143529	10.090399	9.909601	18	12
49	15	9.766115	10.233885	9.856537	10.143463	10.090422	9.909578	45	11
50	30	9.766159	10.233841	9.856604	10.143396	10.090445	9.909555	30	10
51	45	9.766203	10.233797	9.856671	10.143329	10.090467	9.909533	15	9
52	43	9.766247	10.233753	9.856737	10.143263	10.090490	9.909510	17	8
53	15	9.766291	10.233709	9.856804	10.143196	10.090513	9.909487	45	7
54	30	9.766335	10.233665	9.856871	10.143129	10.090536	9.909464	30	6
55	45	9.766379	10.233621	9.856937	10.143063	10.090558	9.909442	15	5
56	44	9.766423	10.233577	9.857004	10.142996	10.090581	9.909419	16	4
57	15	9.766467	10.233533	9.857070	10.142930	10.090604	9.909396	45	3
58	30	9.766511	10.233489	9.857137	10.142863	10.090626	9.909374	30	2
59	45	9.766555	10.233445	9.857204	10.142796	10.090649	9.909351	15	1
60	45	9.766598	10.233402	9.857270	10.142730	10.090672	9.909328	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 37 ^m .		LOG. SINES, &c.						54 deg	

2 ^h 23 ^m .		LOG. SINES, &c. (t.)						35 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.766598	10.233402	9.857270	10.142730	10.090672	9.909328	15	60
1	15	9.766642	10.233358	9.857337	10.142663	10.090695	9.909305	45	59
2	30	9.766686	10.233314	9.857404	10.142596	10.090717	9.909283	30	58
3	45	9.766730	10.233270	9.857470	10.142530	10.090740	9.909260	15	57
4	46	9.766774	10.233226	9.857537	10.142463	10.090763	9.909237	14	56
5	15	9.766818	10.233182	9.857603	10.142397	10.090786	9.909214	45	55
6	30	9.766862	10.233138	9.857670	10.142330	10.090808	9.909192	30	54
7	45	9.766905	10.233095	9.857736	10.142264	10.090831	9.909169	15	53
8	47	9.766949	10.233051	9.857803	10.142197	10.090854	9.909146	13	52
9	15	9.766993	10.233007	9.857870	10.142130	10.090877	9.909123	45	51
10	30	9.767037	10.232963	9.857936	10.142064	10.090899	9.909101	30	50
11	45	9.767081	10.232919	9.858003	10.141997	10.090922	9.909078	15	49
12	48	9.767124	10.232876	9.858069	10.141931	10.090945	9.909055	12	48
13	15	9.767168	10.232832	9.858136	10.141864	10.090968	9.909032	45	47
14	30	9.767212	10.232788	9.858202	10.141798	10.090991	9.909009	30	46
15	45	9.767256	10.232744	9.858269	10.141731	10.091013	9.908987	15	45
16	49	9.767300	10.232700	9.858336	10.141664	10.091036	9.908964	11	44
17	15	9.767343	10.232657	9.858402	10.141598	10.091059	9.908941	45	43
18	30	9.767387	10.232613	9.858469	10.141531	10.091082	9.908918	30	42
19	45	9.767431	10.232569	9.858535	10.141465	10.091105	9.908895	15	41
20	50	9.767475	10.232525	9.858602	10.141398	10.091127	9.908873	10	40
21	15	9.767518	10.232482	9.858668	10.141332	10.091150	9.908850	45	39
22	30	9.767562	10.232438	9.858735	10.141265	10.091173	9.908827	30	38
23	45	9.767606	10.232394	9.858801	10.141199	10.091196	9.908804	15	37
24	51	9.767649	10.232351	9.858868	10.141132	10.091219	9.908781	9	36
25	15	9.767693	10.232307	9.858934	10.141066	10.091241	9.908759	45	35
26	30	9.767737	10.232263	9.859001	10.140999	10.091264	9.908736	30	34
27	45	9.767780	10.232220	9.859068	10.140932	10.091287	9.908713	15	33
28	52	9.767824	10.232176	9.859134	10.140866	10.091310	9.908690	8	32
29	15	9.767868	10.232132	9.859201	10.140799	10.091333	9.908667	45	31
30	30	9.767912	10.232088	9.859267	10.140733	10.091356	9.908644	30	30
31	45	9.767955	10.232045	9.859334	10.140666	10.091378	9.908622	15	29
32	53	9.767999	10.232001	9.859400	10.140600	10.091401	9.908599	7	28
33	15	9.768043	10.231957	9.859467	10.140533	10.091424	9.908576	45	27
34	30	9.768086	10.231914	9.859533	10.140467	10.091447	9.908553	30	26
35	45	9.768130	10.231870	9.859600	10.140400	10.091470	9.908530	15	25
36	54	9.768173	10.231827	9.859666	10.140334	10.091493	9.908507	6	24
37	15	9.768217	10.231783	9.859733	10.140267	10.091516	9.908484	45	23
38	30	9.768261	10.231739	9.859799	10.140201	10.091538	9.908462	30	22
39	45	9.768304	10.231696	9.859866	10.140134	10.091561	9.908439	15	21
40	55	9.768348	10.231652	9.859932	10.140068	10.091584	9.908416	5	20
41	15	9.768392	10.231608	9.859999	10.140001	10.091607	9.908393	45	19
42	30	9.768435	10.231565	9.860065	10.139935	10.091630	9.908370	30	18
43	45	9.768479	10.231521	9.860131	10.139869	10.091653	9.908347	15	17
44	56	9.768522	10.231478	9.860198	10.139802	10.091676	9.908324	4	16
45	15	9.768566	10.231434	9.860264	10.139736	10.091699	9.908301	45	15
46	30	9.768609	10.231391	9.860331	10.139669	10.091722	9.908278	30	14
47	45	9.768653	10.231347	9.860397	10.139603	10.091744	9.908256	15	13
48	57	9.768697	10.231303	9.860464	10.139536	10.091767	9.908233	3	12
49	15	9.768740	10.231260	9.860530	10.139470	10.091790	9.908210	45	11
50	30	9.768784	10.231216	9.860597	10.139403	10.091813	9.908187	30	10
51	45	9.768827	10.231173	9.860663	10.139337	10.091836	9.908164	15	9
52	58	9.768871	10.231129	9.860730	10.139270	10.091859	9.908141	2	8
53	15	9.768914	10.231086	9.860796	10.139204	10.091882	9.908118	45	7
54	30	9.768958	10.231042	9.860862	10.139138	10.091905	9.908095	30	6
55	45	9.769001	10.230999	9.860929	10.139071	10.091928	9.908072	15	5
56	59	9.769045	10.230955	9.860995	10.139005	10.091951	9.908049	1	4
57	15	9.769088	10.230912	9.861062	10.138938	10.091974	9.908026	45	3
58	30	9.769132	10.230868	9.861128	10.138872	10.091997	9.908003	30	2
59	45	9.769175	10.230825	9.861195	10.138805	10.092019	9.907981	15	1
60	60	9.769219	10.230781	9.861261	10.138739	10.092042	9.907958	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 36 ^m .		LOG. SINES, &c.						54 deg.	

2 ^h 24 ^m .		LOG. SINES, &c. (b.)						36 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.769219	10.230781	9.861261	10.138739	10.092042	9.907958	60	60
1	15	9.769262	10.230738	9.861327	10.138673	10.092065	9.907935	45	59
2	30	9.769306	10.230694	9.861394	10.138606	10.092088	9.907912	30	58
3	45	9.769349	10.230651	9.861460	10.138540	10.092111	9.907889	15	57
4	1	9.769392	10.230608	9.861527	10.138473	10.092134	9.907866	59	56
5	15	9.769436	10.230564	9.861593	10.138407	10.092157	9.907843	45	55
6	30	9.769479	10.230521	9.861659	10.138341	10.092180	9.907820	30	54
7	45	9.769523	10.230477	9.861726	10.138274	10.092203	9.907797	15	53
8	2	9.769566	10.230434	9.861792	10.138208	10.092226	9.907774	58	52
9	15	9.769610	10.230390	9.861859	10.138141	10.092249	9.907751	45	51
10	30	9.769653	10.230347	9.861925	10.138075	10.092272	9.907728	30	50
11	45	9.769696	10.230304	9.861991	10.138009	10.092295	9.907705	15	49
12	3	9.769740	10.230260	9.862058	10.137942	10.092318	9.907682	57	48
13	15	9.769783	10.230217	9.862124	10.137876	10.092341	9.907659	45	47
14	30	9.769827	10.230173	9.862191	10.137809	10.092364	9.907636	30	46
15	45	9.769870	10.230130	9.862257	10.137743	10.092387	9.907613	15	45
16	4	9.769913	10.230087	9.862323	10.137677	10.092410	9.907590	56	44
17	15	9.769957	10.230043	9.862390	10.137610	10.092433	9.907567	45	43
18	30	9.770000	10.230000	9.862456	10.137544	10.092456	9.907544	30	42
19	45	9.770043	10.229957	9.862522	10.137478	10.092479	9.907521	15	41
20	5	9.770087	10.229913	9.862589	10.137411	10.092502	9.907498	55	40
21	15	9.770130	10.229870	9.862655	10.137345	10.092525	9.907475	45	39
22	30	9.770173	10.229827	9.862721	10.137279	10.092548	9.907452	30	38
23	45	9.770217	10.229783	9.862788	10.137212	10.092571	9.907429	15	37
24	6	9.770260	10.229740	9.862854	10.137146	10.092594	9.907406	54	36
25	15	9.770303	10.229697	9.862920	10.137080	10.092617	9.907383	45	35
26	30	9.770347	10.229653	9.862987	10.137013	10.092640	9.907360	30	34
27	45	9.770390	10.229610	9.863053	10.136947	10.092663	9.907337	15	33
28	7	9.770433	10.229567	9.863119	10.136881	10.092686	9.907314	53	32
29	15	9.770476	10.229524	9.863186	10.136814	10.092709	9.907291	45	31
30	30	9.770520	10.229480	9.863252	10.136748	10.092732	9.907268	30	30
31	45	9.770563	10.229437	9.863318	10.136682	10.092755	9.907245	15	29
32	8	9.770606	10.229394	9.863385	10.136615	10.092778	9.907222	52	28
33	15	9.770650	10.229350	9.863451	10.136549	10.092802	9.907198	45	27
34	30	9.770693	10.229307	9.863517	10.136483	10.092825	9.907175	30	26
35	45	9.770736	10.229264	9.863584	10.136416	10.092848	9.907152	15	25
36	9	9.770779	10.229221	9.863650	10.136350	10.092871	9.907129	51	24
37	15	9.770822	10.229178	9.863716	10.136284	10.092894	9.907106	45	23
38	30	9.770866	10.229134	9.863783	10.136217	10.092917	9.907083	30	22
39	45	9.770909	10.229091	9.863849	10.136151	10.092940	9.907060	15	21
40	10	9.770952	10.229048	9.863915	10.136085	10.092963	9.907037	50	20
41	15	9.770995	10.229005	9.863981	10.136019	10.092986	9.907014	45	19
42	30	9.771039	10.228961	9.864048	10.135952	10.093009	9.906991	30	18
43	45	9.771082	10.228918	9.864114	10.135886	10.093032	9.906968	15	17
44	11	9.771125	10.228875	9.864180	10.135820	10.093055	9.906945	49	16
45	15	9.771168	10.228832	9.864247	10.135753	10.093079	9.906921	45	15
46	30	9.771211	10.228789	9.864313	10.135687	10.093102	9.906898	30	14
47	45	9.771254	10.228746	9.864379	10.135621	10.093125	9.906875	15	13
48	12	9.771298	10.228702	9.864445	10.135555	10.093148	9.906852	48	12
49	15	9.771341	10.228659	9.864512	10.135488	10.093171	9.906829	45	11
50	30	9.771384	10.228616	9.864578	10.135422	10.093194	9.906806	30	10
51	45	9.771427	10.228573	9.864644	10.135356	10.093217	9.906783	15	9
52	13	9.771470	10.228530	9.864710	10.135290	10.093240	9.906760	47	8
53	15	9.771513	10.228487	9.864777	10.135223	10.093263	9.906737	45	7
54	30	9.771556	10.228444	9.864843	10.135157	10.093286	9.906713	30	6
55	45	9.771599	10.228401	9.864909	10.135091	10.093310	9.906690	15	5
56	14	9.771643	10.228357	9.864975	10.135025	10.093333	9.906667	46	4
57	15	9.771686	10.228314	9.865042	10.134958	10.093356	9.906644	45	3
58	30	9.771729	10.228271	9.865108	10.134892	10.093379	9.906621	30	2
59	45	9.771772	10.228228	9.865174	10.134826	10.093402	9.906598	15	1
60	15	9.771815	10.228185	9.865240	10.134760	10.093426	9.906574	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 35 ^m .		LOG. SINES, &c.						53 deg.	

2 ^h 25 ^m .			LOG. SINES, &c. (t.)				36 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.771815	10.228185	9.865240	10.134760	10.093426	9.906574	45	60
1	15	9.771858	10.228142	9.865307	10.134693	10.093449	9.906551	45	59
2	30	9.771901	10.228099	9.865373	10.134627	10.093472	9.906528	30	58
3	45	9.771944	10.228056	9.865439	10.134561	10.093495	9.906505	15	57
4	16	9.771987	10.228013	9.865505	10.134495	10.093518	9.906482	44	56
5	15	9.772030	10.227970	9.865571	10.134429	10.093541	9.906459	45	55
6	30	9.772073	10.227927	9.865638	10.134362	10.093565	9.906436	30	54
7	45	9.772116	10.227884	9.865704	10.134296	10.093588	9.906412	15	53
8	17	9.772159	10.227841	9.865770	10.134230	10.093611	9.906389	43	52
9	15	9.772202	10.227798	9.865836	10.134164	10.093634	9.906366	45	51
10	30	9.772245	10.227755	9.865903	10.134097	10.093657	9.906343	30	50
11	45	9.772288	10.227712	9.865969	10.134031	10.093680	9.906320	15	49
12	18	9.772331	10.227669	9.866035	10.133965	10.093704	9.906296	42	48
13	15	9.772374	10.227626	9.866101	10.133899	10.093727	9.906273	45	47
14	30	9.772417	10.227583	9.866167	10.133833	10.093750	9.906250	30	46
15	45	9.772460	10.227540	9.866233	10.133767	10.093773	9.906227	15	45
16	19	9.772503	10.227497	9.866300	10.133700	10.093796	9.906204	41	44
17	15	9.772546	10.227454	9.866366	10.133634	10.093820	9.906180	45	43
18	30	9.772589	10.227411	9.866432	10.133568	10.093843	9.906157	30	42
19	45	9.772632	10.227368	9.866498	10.133502	10.093866	9.906134	15	41
20	20	9.772675	10.227325	9.866564	10.133436	10.093889	9.906111	40	40
21	15	9.772718	10.227282	9.866631	10.133369	10.093913	9.906087	45	39
22	30	9.772761	10.227239	9.866697	10.133303	10.093936	9.906064	30	38
23	45	9.772804	10.227196	9.866763	10.133237	10.093959	9.906041	15	37
24	21	9.772847	10.227153	9.866829	10.133171	10.093982	9.906018	39	36
25	15	9.772890	10.227110	9.866895	10.133105	10.094006	9.905994	45	35
26	30	9.772933	10.227067	9.866961	10.133039	10.094029	9.905971	30	34
27	45	9.772976	10.227024	9.867028	10.132972	10.094052	9.905948	15	33
28	22	9.773018	10.226982	9.867094	10.132906	10.094075	9.905925	38	32
29	15	9.773061	10.226939	9.867160	10.132840	10.094099	9.905901	45	31
30	30	9.773104	10.226896	9.867226	10.132774	10.094122	9.905878	30	30
31	45	9.773147	10.226853	9.867292	10.132708	10.094145	9.905855	15	29
32	23	9.773190	10.226810	9.867358	10.132642	10.094168	9.905832	37	28
33	15	9.773233	10.226767	9.867424	10.132576	10.094192	9.905808	45	27
34	30	9.773276	10.226724	9.867490	10.132510	10.094215	9.905785	30	26
35	45	9.773318	10.226682	9.867557	10.132443	10.094238	9.905762	15	25
36	24	9.773361	10.226639	9.867623	10.132377	10.094261	9.905739	36	24
37	15	9.773404	10.226596	9.867689	10.132311	10.094285	9.905715	45	23
38	30	9.773447	10.226553	9.867755	10.132245	10.094308	9.905692	30	22
39	45	9.773490	10.226510	9.867821	10.132179	10.094331	9.905669	15	21
40	25	9.773533	10.226467	9.867887	10.132113	10.094355	9.905645	35	20
41	15	9.773575	10.226425	9.867953	10.132047	10.094378	9.905622	45	19
42	30	9.773618	10.226382	9.868019	10.131981	10.094401	9.905599	30	18
43	45	9.773661	10.226339	9.868086	10.131914	10.094425	9.905575	15	17
44	26	9.773704	10.226296	9.868152	10.131848	10.094448	9.905552	34	16
45	15	9.773747	10.226253	9.868218	10.131782	10.094471	9.905529	45	15
46	30	9.773789	10.226211	9.868284	10.131716	10.094494	9.905506	30	14
47	45	9.773832	10.226168	9.868350	10.131650	10.094518	9.905482	15	13
48	27	9.773875	10.226125	9.868416	10.131584	10.094541	9.905459	33	12
49	15	9.773918	10.226082	9.868482	10.131518	10.094564	9.905436	45	11
50	30	9.773960	10.226040	9.868548	10.131452	10.094588	9.905412	30	10
51	45	9.774003	10.225997	9.868614	10.131386	10.094611	9.905389	15	9
52	28	9.774046	10.225954	9.868680	10.131320	10.094634	9.905366	32	8
53	15	9.774089	10.225911	9.868746	10.131254	10.094658	9.905342	45	7
54	30	9.774131	10.225869	9.868812	10.131188	10.094681	9.905319	30	6
55	45	9.774174	10.225826	9.868879	10.131121	10.094705	9.905295	15	5
56	29	9.774217	10.225783	9.868945	10.131055	10.094728	9.905272	31	4
57	15	9.774259	10.225741	9.869011	10.130989	10.094751	9.905249	45	3
58	30	9.774302	10.225698	9.869077	10.130923	10.094775	9.905225	30	2
59	45	9.774345	10.225655	9.869143	10.130857	10.094798	9.905202	15	1
60	30	9.774388	10.225612	9.869209	10.130791	10.094821	9.905179	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 34 ^m .			LOG. SINES, &c.				53 deg.		

2 ^h 26 ^m .			LOG. SINES, &c. (L.)						36 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0	30		9.774388	10.225612	9.869209	10.130791	10.094821	9.905179	30		60
1	15		9.774430	10.225570	9.869275	10.130725	10.094845	9.905155	45		59
2	30		9.774473	10.225527	9.869341	10.130659	10.094868	9.905132	30		58
3	45		9.774516	10.225484	9.869407	10.130593	10.094891	9.905109	15		57
4	31		9.774558	10.225442	9.869473	10.130527	10.094915	9.905085	29		56
5	15		9.774601	10.225399	9.869539	10.130461	10.094938	9.905062	45		55
6	30		9.774644	10.225356	9.869605	10.130395	10.094962	9.905038	30		54
7	45		9.774686	10.225314	9.869671	10.130329	10.094985	9.905015	15		53
8	32		9.774729	10.225271	9.869737	10.130263	10.095008	9.904992	28		52
9	15		9.774771	10.225229	9.869803	10.130197	10.095032	9.904968	45		51
10	30		9.774814	10.225186	9.869869	10.130131	10.095055	9.904945	30		50
11	45		9.774857	10.225143	9.869935	10.130065	10.095079	9.904921	15		49
12	33		9.774899	10.225101	9.870001	10.129999	10.095102	9.904898	27		48
13	15		9.774942	10.225058	9.870067	10.129933	10.095125	9.904875	45		47
14	30		9.774984	10.225016	9.870133	10.129867	10.095149	9.904851	30		46
15	45		9.775027	10.224973	9.870199	10.129801	10.095172	9.904828	15		45
16	34		9.775070	10.224930	9.870265	10.129735	10.095196	9.904804	26		44
17	15		9.775112	10.224888	9.870331	10.129669	10.095219	9.904781	45		43
18	30		9.775155	10.224845	9.870397	10.129603	10.095243	9.904757	30		42
19	45		9.775197	10.224803	9.870463	10.129537	10.095266	9.904734	15		41
20	35		9.775240	10.224760	9.870529	10.129471	10.095289	9.904711	25		40
21	15		9.775282	10.224718	9.870595	10.129405	10.095313	9.904687	45		39
22	30		9.775325	10.224675	9.870661	10.129339	10.095336	9.904664	30		38
23	45		9.775368	10.224632	9.870727	10.129273	10.095360	9.904640	15		37
24	36		9.775410	10.224590	9.870793	10.129207	10.095383	9.904617	24		36
25	15		9.775453	10.224547	9.870859	10.129141	10.095407	9.904593	45		35
26	30		9.775495	10.224505	9.870925	10.129075	10.095430	9.904570	30		34
27	45		9.775538	10.224462	9.870991	10.129009	10.095454	9.904546	15		33
28	37		9.775580	10.224420	9.871057	10.128943	10.095477	9.904523	23		32
29	15		9.775623	10.224377	9.871123	10.128877	10.095501	9.904499	45		31
30	30		9.775665	10.224335	9.871189	10.128811	10.095524	9.904476	30		30
31	45		9.775708	10.224292	9.871255	10.128745	10.095548	9.904452	15		29
32	38		9.775750	10.224250	9.871321	10.128679	10.095571	9.904429	22		28
33	15		9.775793	10.224207	9.871387	10.128613	10.095594	9.904406	45		27
34	30		9.775835	10.224165	9.871453	10.128547	10.095618	9.904382	30		26
35	45		9.775877	10.224123	9.871519	10.128481	10.095641	9.904359	15		25
36	39		9.775920	10.224080	9.871585	10.128415	10.095665	9.904335	21		24
37	15		9.775962	10.224038	9.871651	10.128349	10.095688	9.904312	45		23
38	30		9.776005	10.223995	9.871717	10.128283	10.095712	9.904288	30		22
39	45		9.776047	10.223953	9.871783	10.128217	10.095735	9.904265	15		21
40	40		9.776090	10.223910	9.871849	10.128151	10.095759	9.904241	20		20
41	15		9.776132	10.223868	9.871914	10.128086	10.095782	9.904218	45		19
42	30		9.776174	10.223826	9.871980	10.128020	10.095806	9.904194	30		18
43	45		9.776217	10.223783	9.872046	10.127954	10.095830	9.904170	15		17
44	41		9.776259	10.223741	9.872112	10.127888	10.095853	9.904147	19		16
45	15		9.776302	10.223698	9.872178	10.127822	10.095877	9.904123	45		15
46	30		9.776344	10.223656	9.872244	10.127756	10.095900	9.904100	30		14
47	45		9.776386	10.223614	9.872310	10.127690	10.095924	9.904076	15		13
48	42		9.776429	10.223571	9.872376	10.127624	10.095947	9.904053	18		12
49	15		9.776471	10.223529	9.872442	10.127558	10.095971	9.904029	45		11
50	30		9.776514	10.223486	9.872508	10.127492	10.095994	9.904006	30		10
51	45		9.776556	10.223444	9.872574	10.127426	10.096018	9.903982	15		9
52	43		9.776598	10.223402	9.872640	10.127360	10.096041	9.903959	17		8
53	15		9.776641	10.223359	9.872705	10.127295	10.096065	9.903935	45		7
54	30		9.776683	10.223317	9.872771	10.127229	10.096089	9.903911	30		6
55	45		9.776725	10.223275	9.872837	10.127163	10.096112	9.903888	15		5
56	44		9.776768	10.223232	9.872903	10.127097	10.096136	9.903864	16		4
57	15		9.776810	10.223190	9.872969	10.127031	10.096159	9.903841	45		3
58	30		9.776852	10.223148	9.873035	10.126965	10.096183	9.903817	30		2
59	45		9.776895	10.223105	9.873101	10.126899	10.096206	9.903794	15		1
60	45		9.776937	10.223063	9.873167	10.126833	10.096230	9.903770	15		0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.
3 ^h 33 ^m .			LOG. SINES, &c.						53 deg.		

2 ^h 27 ^m .			LOG. SINES, &c. (t.)					36 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	sec.
0	45		9.776937	10.223063	9.873167	10.126833	10.096230	9.903770	15	60
1		15	9.776979	10.223021	9.873233	10.126767	10.096254	9.903746	45	59
2		30	9.777021	10.222979	9.873298	10.126702	10.096277	9.903723	30	58
3		45	9.777064	10.222936	9.873364	10.126636	10.096301	9.903699	15	57
4	46		9.777106	10.222894	9.873430	10.126570	10.096324	9.903676	14	56
5		15	9.777148	10.222852	9.873496	10.126504	10.096348	9.903652	45	55
6		30	9.777190	10.222810	9.873562	10.126438	10.096372	9.903628	30	54
7		45	9.777233	10.222767	9.873628	10.126372	10.096395	9.903605	15	53
8	47		9.777275	10.222725	9.873694	10.126306	10.096419	9.903581	13	52
9		15	9.777317	10.222683	9.873759	10.126241	10.096442	9.903558	45	51
10		30	9.777359	10.222641	9.873825	10.126175	10.096466	9.903534	30	50
11		45	9.777402	10.222598	9.873891	10.126109	10.096490	9.903510	15	49
12	48		9.777444	10.222556	9.873957	10.126043	10.096513	9.903487	12	48
13		15	9.777486	10.222514	9.874023	10.125977	10.096537	9.903463	45	47
14		30	9.777528	10.222472	9.874089	10.125911	10.096560	9.903440	30	46
15		45	9.777571	10.222429	9.874155	10.125845	10.096584	9.903416	15	45
16	49		9.777613	10.222387	9.874220	10.125780	10.096608	9.903392	11	44
17		15	9.777655	10.222345	9.874286	10.125714	10.096631	9.903369	45	43
18		30	9.777697	10.222303	9.874352	10.125648	10.096655	9.903345	30	42
19		45	9.777739	10.222261	9.874418	10.125582	10.096679	9.903321	15	41
20	50		9.777781	10.222219	9.874484	10.125516	10.096702	9.903298	10	40
21		15	9.777824	10.222176	9.874550	10.125450	10.096726	9.903274	45	39
22		30	9.777866	10.222134	9.874615	10.125385	10.096750	9.903250	30	38
23		45	9.777908	10.222092	9.874681	10.125319	10.096773	9.903227	15	37
24	51		9.777950	10.222050	9.874747	10.125253	10.096797	9.903203	9	36
25		15	9.777992	10.222008	9.874813	10.125187	10.096821	9.903179	45	35
26		30	9.778034	10.221966	9.874879	10.125121	10.096844	9.903156	30	34
27		45	9.778076	10.221924	9.874944	10.125056	10.096868	9.903132	15	33
28	52		9.778119	10.221881	9.875010	10.124990	10.096892	9.903108	8	32
29		15	9.778161	10.221839	9.875076	10.124924	10.096915	9.903085	45	31
30		30	9.778203	10.221797	9.875142	10.124858	10.096939	9.903061	30	30
31		45	9.778245	10.221755	9.875208	10.124792	10.096963	9.903037	15	29
32	53		9.778287	10.221713	9.875273	10.124727	10.096986	9.903014	7	28
33		15	9.778329	10.221671	9.875339	10.124661	10.097010	9.902990	45	27
34		30	9.778371	10.221629	9.875405	10.124595	10.097034	9.902966	30	26
35		45	9.778413	10.221587	9.875471	10.124529	10.097058	9.902942	15	25
36	54		9.778455	10.221545	9.875536	10.124464	10.097081	9.902919	6	24
37		15	9.778497	10.221503	9.875602	10.124398	10.097105	9.902895	45	23
38		30	9.778539	10.221461	9.875668	10.124332	10.097129	9.902871	30	22
39		45	9.778581	10.221419	9.875734	10.124266	10.097152	9.902848	15	21
40	55		9.778623	10.221377	9.875800	10.124200	10.097176	9.902824	5	20
41		15	9.778666	10.221334	9.875865	10.124135	10.097200	9.902800	45	19
42		30	9.778708	10.221292	9.875931	10.124069	10.097224	9.902776	30	18
43		45	9.778750	10.221250	9.875997	10.124003	10.097247	9.902753	15	17
44	56		9.778792	10.221208	9.876063	10.123937	10.097271	9.902729	4	16
45		15	9.778834	10.221166	9.876128	10.123872	10.097295	9.902705	45	15
46		30	9.778876	10.221124	9.876194	10.123806	10.097319	9.902681	30	14
47		45	9.778918	10.221082	9.876260	10.123740	10.097342	9.902658	15	13
48	57		9.778960	10.221040	9.876326	10.123674	10.097366	9.902634	3	12
49		15	9.779002	10.220998	9.876391	10.123609	10.097390	9.902610	45	11
50		30	9.779044	10.220956	9.876457	10.123543	10.097414	9.902586	30	10
51		45	9.779086	10.220914	9.876523	10.123477	10.097437	9.902563	15	9
52	58		9.779127	10.220873	9.876589	10.123411	10.097461	9.902539	2	8
53		15	9.779169	10.220831	9.876654	10.123346	10.097485	9.902515	45	7
54		30	9.779211	10.220789	9.876720	10.123280	10.097509	9.902491	30	6
55		45	9.779253	10.220747	9.876786	10.123214	10.097532	9.902468	15	5
56	59		9.779295	10.220705	9.876851	10.123149	10.097556	9.902444	1	4
57		15	9.779337	10.220663	9.876917	10.123083	10.097580	9.902420	45	3
58		30	9.779379	10.220621	9.876983	10.123017	10.097604	9.902396	30	2
59		45	9.779421	10.220579	9.877049	10.122951	10.097628	9.902372	15	1
60	60		9.779463	10.220537	9.877114	10.122886	10.097651	9.902349	0	0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	sec.
3 ^h 32 ^m .			LOG. SINES, &c.					53 deg.		

2^h 28^m.

LOG. SINES, &c. (t.)

37 deg.

sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.779463	10.220537	9.877114	10.122886	10.097651	9.902349	60	60
1	15	9.779505	10.220495	9.877180	10.122820	10.097675	9.902325	45	59
2	30	9.779547	10.220453	9.877246	10.122754	10.097699	9.902301	30	58
3	45	9.779589	10.220411	9.877311	10.122689	10.097723	9.902277	15	57
4	1	9.779631	10.220369	9.877377	10.122623	10.097747	9.902253	59	56
5	15	9.779672	10.220328	9.877443	10.122557	10.097770	9.902230	45	55
6	30	9.779714	10.220286	9.877509	10.122491	10.097794	9.902206	30	54
7	45	9.779756	10.220244	9.877574	10.122426	10.097818	9.902182	15	53
8	2	9.779798	10.220202	9.877640	10.122360	10.097842	9.902158	58	52
9	15	9.779840	10.220160	9.877706	10.122294	10.097866	9.902134	45	51
10	30	9.779882	10.220118	9.877771	10.122229	10.097890	9.902110	30	50
11	45	9.779924	10.220076	9.877837	10.122163	10.097913	9.902087	15	49
12	3	9.779965	10.220035	9.877903	10.122097	10.097937	9.902063	57	48
13	15	9.780007	10.219993	9.877968	10.122032	10.097961	9.902039	45	47
14	30	9.780049	10.219951	9.878034	10.121966	10.097985	9.902015	30	46
15	45	9.780091	10.219909	9.878100	10.121900	10.098009	9.901991	15	45
16	4	9.780133	10.219867	9.878165	10.121835	10.098033	9.901967	56	44
17	15	9.780175	10.219825	9.878231	10.121769	10.098057	9.901943	45	43
18	30	9.780216	10.219784	9.878297	10.121703	10.098080	9.901920	30	42
19	45	9.780258	10.219742	9.878362	10.121638	10.098104	9.901896	15	41
20	5	9.780300	10.219700	9.878428	10.121572	10.098128	9.901872	55	40
21	15	9.780342	10.219658	9.878494	10.121506	10.098152	9.901848	45	39
22	30	9.780384	10.219616	9.878559	10.121441	10.098176	9.901824	30	38
23	45	9.780425	10.219575	9.878625	10.121375	10.098200	9.901800	15	37
24	6	9.780467	10.219533	9.878691	10.121309	10.098224	9.901776	54	36
25	15	9.780509	10.219491	9.878756	10.121244	10.098248	9.901752	45	35
26	30	9.780551	10.219449	9.878822	10.121178	10.098271	9.901729	30	34
27	45	9.780592	10.219408	9.878888	10.121112	10.098295	9.901705	15	33
28	7	9.780634	10.219366	9.878953	10.121047	10.098319	9.901681	53	32
29	15	9.780676	10.219324	9.879019	10.120981	10.098343	9.901657	45	31
30	30	9.780717	10.219283	9.879084	10.120916	10.098367	9.901633	30	30
31	45	9.780759	10.219241	9.879150	10.120850	10.098391	9.901609	15	29
32	8	9.780801	10.219199	9.879216	10.120784	10.098415	9.901585	52	28
33	15	9.780843	10.219157	9.879281	10.120719	10.098439	9.901561	45	27
34	30	9.780884	10.219116	9.879347	10.120653	10.098463	9.901537	30	26
35	45	9.780926	10.219074	9.879413	10.120587	10.098487	9.901513	15	25
36	9	9.780968	10.219032	9.879478	10.120522	10.098511	9.901489	51	24
37	15	9.781009	10.218991	9.879544	10.120456	10.098534	9.901466	45	23
38	30	9.781051	10.218949	9.879609	10.120391	10.098558	9.901442	30	22
39	45	9.781093	10.218907	9.879675	10.120325	10.098582	9.901418	15	21
40	10	9.781134	10.218866	9.879741	10.120259	10.098606	9.901394	50	20
41	15	9.781176	10.218824	9.879806	10.120194	10.098630	9.901370	45	19
42	30	9.781218	10.218782	9.879872	10.120128	10.098654	9.901346	30	18
43	45	9.781259	10.218741	9.879937	10.120063	10.098678	9.901322	15	17
44	11	9.781301	10.218699	9.880003	10.119997	10.098702	9.901298	49	16
45	15	9.781343	10.218657	9.880069	10.119931	10.098726	9.901274	45	15
46	30	9.781384	10.218616	9.880134	10.119866	10.098750	9.901250	30	14
47	45	9.781426	10.218574	9.880200	10.119800	10.098774	9.901226	15	13
48	12	9.781467	10.218533	9.880265	10.119735	10.098798	9.901202	48	12
49	15	9.781509	10.218491	9.880331	10.119669	10.098822	9.901178	45	11
50	30	9.781551	10.218449	9.880397	10.119603	10.098846	9.901154	30	10
51	45	9.781592	10.218408	9.880462	10.119538	10.098870	9.901130	15	9
52	13	9.781634	10.218366	9.880528	10.119472	10.098894	9.901106	47	8
53	15	9.781675	10.218325	9.880593	10.119407	10.098918	9.901082	45	7
54	30	9.781717	10.218283	9.880659	10.119341	10.098942	9.901058	30	6
55	45	9.781759	10.218241	9.880724	10.119276	10.098966	9.901034	15	5
56	14	9.781800	10.218200	9.880790	10.119210	10.098990	9.901010	46	4
57	15	9.781842	10.218158	9.880855	10.119145	10.099014	9.900986	45	3
58	30	9.781883	10.218117	9.880921	10.119079	10.099038	9.900962	30	2
59	45	9.781925	10.218075	9.880987	10.119013	10.099062	9.900938	15	1
60	15	9.781966	10.218034	9.881052	10.118948	10.099086	9.900914	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.

3^h 31^m.

LOG. SINES, &c.

52 deg.

2 ^h 29 ^m .		LOG. SINES, &c. (t.)						37 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.781966	10.218034	9.881052	10.118948	10.099086	9.900914	45	60
1	15	9.782008	10.217992	9.881118	10.118882	10.099110	9.900890	45	59
2	30	9.782049	10.217951	9.881183	10.118817	10.099134	9.900866	30	58
3	45	9.782091	10.217909	9.881249	10.118751	10.099158	9.900842	15	57
4	16	9.782132	10.217868	9.881314	10.118686	10.099182	9.900818	44	56
5	15	9.782174	10.217826	9.881380	10.118620	10.099206	9.900794	45	55
6	30	9.782215	10.217785	9.881445	10.118555	10.099230	9.900770	30	54
7	45	9.782257	10.217743	9.881511	10.118489	10.099254	9.900746	15	53
8	17	9.782298	10.217702	9.881576	10.118424	10.099278	9.900722	43	52
9	15	9.782340	10.217660	9.881642	10.118358	10.099302	9.900698	45	51
10	30	9.782381	10.217619	9.881708	10.118292	10.099326	9.900674	30	50
11	45	9.782423	10.217577	9.881773	10.118227	10.099350	9.900650	15	49
12	18	9.782464	10.217536	9.881839	10.118161	10.099374	9.900626	42	48
13	15	9.782506	10.217494	9.881904	10.118096	10.099398	9.900602	45	47
14	30	9.782547	10.217453	9.881970	10.118030	10.099422	9.900578	30	46
15	45	9.782589	10.217411	9.882035	10.117965	10.099447	9.900553	15	45
16	19	9.782630	10.217370	9.882101	10.117899	10.099471	9.900529	41	44
17	15	9.782671	10.217329	9.882166	10.117834	10.099495	9.900505	45	43
18	30	9.782713	10.217287	9.882232	10.117768	10.099519	9.900481	30	42
19	45	9.782754	10.217246	9.882297	10.117703	10.099543	9.900457	15	41
20	20	9.782796	10.217204	9.882363	10.117637	10.099567	9.900433	40	40
21	15	9.782837	10.217163	9.882428	10.117572	10.099591	9.900409	45	39
22	30	9.782879	10.217121	9.882494	10.117506	10.099615	9.900385	30	38
23	45	9.782920	10.217080	9.882559	10.117441	10.099639	9.900361	15	37
24	21	9.782961	10.217039	9.882625	10.117375	10.099663	9.900337	39	36
25	15	9.783003	10.216997	9.882690	10.117310	10.099687	9.900313	45	35
26	30	9.783044	10.216956	9.882756	10.117244	10.099712	9.900288	30	34
27	45	9.783085	10.216915	9.882821	10.117179	10.099736	9.900264	15	33
28	22	9.783127	10.216873	9.882887	10.117113	10.099760	9.900240	38	32
29	15	9.783168	10.216832	9.882952	10.117048	10.099784	9.900216	45	31
30	30	9.783209	10.216791	9.883017	10.116983	10.099808	9.900192	30	30
31	45	9.783251	10.216749	9.883083	10.116917	10.099832	9.900168	15	29
32	23	9.783292	10.216708	9.883148	10.116852	10.099856	9.900144	37	28
33	15	9.783334	10.216666	9.883214	10.116786	10.099880	9.900120	45	27
34	30	9.783375	10.216625	9.883279	10.116721	10.099905	9.900095	30	26
35	45	9.783416	10.216584	9.883345	10.116655	10.099929	9.900071	15	25
36	24	9.783457	10.216543	9.883410	10.116590	10.099953	9.900047	36	24
37	15	9.783499	10.216501	9.883476	10.116524	10.099977	9.900023	45	23
38	30	9.783540	10.216460	9.883541	10.116459	10.100001	9.899999	30	22
39	45	9.783581	10.216419	9.883607	10.116393	10.100025	9.899975	15	21
40	25	9.783623	10.216377	9.883672	10.116328	10.100049	9.899951	35	20
41	15	9.783664	10.216336	9.883737	10.116263	10.100074	9.899926	45	19
42	30	9.783705	10.216295	9.883803	10.116197	10.100098	9.899902	30	18
43	45	9.783746	10.216254	9.883868	10.116132	10.100122	9.899878	15	17
44	26	9.783788	10.216212	9.883934	10.116066	10.100146	9.899854	34	16
45	15	9.783829	10.216171	9.883999	10.116001	10.100170	9.899830	45	15
46	30	9.783870	10.216130	9.884065	10.115935	10.100194	9.899806	30	14
47	45	9.783911	10.216089	9.884130	10.115870	10.100219	9.899781	15	13
48	27	9.783953	10.216047	9.884196	10.115804	10.100243	9.899757	33	12
49	15	9.783994	10.216006	9.884261	10.115739	10.100267	9.899733	45	11
50	30	9.784035	10.215965	9.884326	10.115674	10.100291	9.899709	30	10
51	45	9.784076	10.215924	9.884392	10.115608	10.100315	9.899685	15	9
52	28	9.784118	10.215882	9.884457	10.115543	10.100340	9.899660	32	8
53	15	9.784159	10.215841	9.884523	10.115477	10.100364	9.899636	45	7
54	30	9.784200	10.215800	9.884588	10.115412	10.100388	9.899612	30	6
55	45	9.784241	10.215759	9.884653	10.115347	10.100412	9.899588	15	5
56	29	9.784282	10.215718	9.884719	10.115281	10.100436	9.899564	31	4
57	15	9.784324	10.215676	9.884784	10.115216	10.100461	9.899539	45	3
58	30	9.784365	10.215635	9.884850	10.115150	10.100485	9.899515	30	2
59	45	9.784406	10.215594	9.884915	10.115085	10.100509	9.899491	15	1
60	30	9.784447	10.215553	9.884980	10.115020	10.100533	9.899467	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 30 ^m .		LOG. SINES &c.						52 deg.	

2 ^h 30 ^m			LOG. SINES, &c. (t.)					37 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	30	9.784447	10.215553	9.884980	10.115020	10.100533	9.899467	30	60	
1	15	9.784488	10.215512	9.885046	10.114954	10.100558	9.899442	45	59	
2	30	9.784529	10.215471	9.885111	10.114889	10.100582	9.899418	30	58	
3	45	9.784571	10.215429	9.885177	10.114823	10.100606	9.899394	15	57	
4	31	9.784612	10.215388	9.885242	10.114758	10.100630	9.899370	29	56	
5	15	9.784653	10.215347	9.885307	10.114693	10.100655	9.899345	45	55	
6	30	9.784694	10.215306	9.885373	10.114627	10.100679	9.899321	30	54	
7	45	9.784735	10.215265	9.885438	10.114562	10.100703	9.899297	15	53	
8	32	9.784776	10.215224	9.885503	10.114497	10.100727	9.899273	28	52	
9	15	9.784817	10.215183	9.885569	10.114431	10.100752	9.899248	45	51	
10	30	9.784858	10.215142	9.885634	10.114366	10.100776	9.899224	30	50	
11	45	9.784899	10.215101	9.885700	10.114300	10.100800	9.899200	15	49	
12	33	9.784941	10.215059	9.885765	10.114235	10.100824	9.899176	27	48	
13	15	9.784982	10.215018	9.885830	10.114170	10.100849	9.899151	45	47	
14	30	9.785023	10.214977	9.885896	10.114104	10.100873	9.899127	30	46	
15	45	9.785064	10.214936	9.885961	10.114039	10.100897	9.899103	15	45	
16	34	9.785105	10.214895	9.886026	10.113974	10.100922	9.899078	26	44	
17	15	9.785146	10.214854	9.886092	10.113908	10.100946	9.899054	45	43	
18	30	9.785187	10.214813	9.886157	10.113843	10.100970	9.899030	30	42	
19	45	9.785228	10.214772	9.886222	10.113778	10.100995	9.899005	15	41	
20	35	9.785269	10.214731	9.886288	10.113712	10.101019	9.898981	25	40	
21	15	9.785310	10.214690	9.886353	10.113647	10.101043	9.898957	45	39	
22	30	9.785351	10.214649	9.886418	10.113582	10.101067	9.898933	30	38	
23	45	9.785392	10.214608	9.886484	10.113516	10.101092	9.898908	15	37	
24	36	9.785433	10.214567	9.886549	10.113451	10.101116	9.898884	24	36	
25	15	9.785474	10.214526	9.886614	10.113386	10.101140	9.898860	45	35	
26	30	9.785515	10.214485	9.886680	10.113320	10.101165	9.898835	30	34	
27	45	9.785556	10.214444	9.886745	10.113255	10.101189	9.898811	15	33	
28	37	9.785597	10.214403	9.886810	10.113190	10.101213	9.898787	23	32	
29	15	9.785638	10.214362	9.886876	10.113124	10.101238	9.898762	45	31	
30	30	9.785679	10.214321	9.886941	10.113059	10.101262	9.898738	30	30	
31	45	9.785720	10.214280	9.887006	10.112994	10.101286	9.898714	15	29	
32	38	9.785761	10.214239	9.887072	10.112928	10.101311	9.898689	22	28	
33	15	9.785802	10.214198	9.887137	10.112863	10.101335	9.898665	45	27	
34	30	9.785843	10.214157	9.887202	10.112798	10.101359	9.898641	30	26	
35	45	9.785884	10.214116	9.887268	10.112732	10.101384	9.898616	15	25	
36	39	9.785925	10.214075	9.887333	10.112667	10.101408	9.898592	21	24	
37	15	9.785966	10.214034	9.887398	10.112602	10.101433	9.898567	45	23	
38	30	9.786007	10.213993	9.887464	10.112536	10.101457	9.898543	30	22	
39	45	9.786048	10.213952	9.887529	10.112471	10.101481	9.898519	15	21	
40	40	9.786089	10.213911	9.887594	10.112406	10.101506	9.898494	20	20	
41	15	9.786129	10.213870	9.887659	10.112341	10.101530	9.898470	45	19	
42	30	9.786170	10.213830	9.887725	10.112275	10.101554	9.898446	30	18	
43	45	9.786211	10.213789	9.887790	10.112210	10.101579	9.898421	15	17	
44	41	9.786252	10.213748	9.887855	10.112145	10.101603	9.898397	19	16	
45	15	9.786293	10.213707	9.887921	10.112079	10.101628	9.898372	45	15	
46	30	9.786334	10.213666	9.887986	10.112014	10.101652	9.898348	30	14	
47	45	9.786375	10.213625	9.888051	10.111949	10.101676	9.898324	15	13	
48	42	9.786416	10.213584	9.888116	10.111884	10.101701	9.898299	18	12	
49	15	9.786456	10.213544	9.888182	10.111818	10.101725	9.898275	45	11	
50	30	9.786497	10.213503	9.888247	10.111753	10.101750	9.898250	30	10	
51	45	9.786538	10.213462	9.888312	10.111688	10.101774	9.898226	15	9	
52	43	9.786579	10.213421	9.888377	10.111623	10.101799	9.898201	17	8	
53	15	9.786620	10.213380	9.888443	10.111557	10.101823	9.898177	45	7	
54	30	9.786661	10.213339	9.888508	10.111492	10.101847	9.898153	30	6	
55	45	9.786702	10.213298	9.888573	10.111427	10.101872	9.898128	15	5	
56	44	9.786742	10.213258	9.888639	10.111361	10.101896	9.898104	16	4	
57	15	9.786783	10.213217	9.888704	10.111296	10.101921	9.898079	45	3	
58	30	9.786824	10.213176	9.888769	10.111231	10.101945	9.898055	30	2	
59	45	9.786865	10.213135	9.888834	10.111166	10.101970	9.898030	15	1	
60	45	9.786906	10.213094	9.888900	10.111100	10.101994	9.898006	15	0	
sec.	"	sine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.	
3 ^h 29 ^m			LOG. SINES, &c.					52 deg.		

2 ^h 31 ^m .			LOG. SINES, &c. (t.)						37 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.	
0	45	9.786906	10.213094	9.888900	10.111100	10.101994	9.898006	15		60	
1	15	9.786946	10.213054	9.888965	10.111035	10.102018	9.897982	45		59	
2	30	9.786987	10.213013	9.889030	10.110970	10.102043	9.897957	30		58	
3	45	9.787028	10.212972	9.889095	10.110905	10.102067	9.897933	15		57	
4	46	9.787069	10.212931	9.889160	10.110840	10.102092	9.897908	14		56	
5	15	9.787109	10.212891	9.889226	10.110774	10.102116	9.897884	45		55	
6	30	9.787150	10.212850	9.889291	10.110709	10.102141	9.897859	30		54	
7	45	9.787191	10.212809	9.889356	10.110644	10.102165	9.897835	15		53	
8	47	9.787232	10.212768	9.889421	10.110579	10.102190	9.897810	13		52	
9	15	9.787272	10.212728	9.889487	10.110513	10.102214	9.897786	45		51	
10	30	9.787313	10.212687	9.889552	10.110448	10.102239	9.897761	30		50	
11	45	9.787354	10.212646	9.889617	10.110383	10.102263	9.897737	15		49	
12	48	9.787395	10.212605	9.889682	10.110318	10.102288	9.897712	12		48	
13	15	9.787435	10.212565	9.889747	10.110253	10.102312	9.897688	45		47	
14	30	9.787476	10.212524	9.889813	10.110187	10.102337	9.897663	30		46	
15	45	9.787517	10.212483	9.889878	10.110122	10.102361	9.897639	15		45	
16	49	9.787557	10.212443	9.889943	10.110057	10.102386	9.897614	11		44	
17	15	9.787598	10.212402	9.890008	10.109992	10.102410	9.897590	45		43	
18	30	9.787639	10.212361	9.890074	10.109926	10.102435	9.897565	30		42	
19	45	9.787679	10.212321	9.890139	10.109861	10.102459	9.897541	15		41	
20	50	9.787720	10.212280	9.890204	10.109796	10.102484	9.897516	10		40	
21	15	9.787761	10.212239	9.890269	10.109731	10.102508	9.897492	45		39	
22	30	9.787801	10.212199	9.890334	10.109666	10.102533	9.897467	30		38	
23	45	9.787842	10.212158	9.890399	10.109601	10.102557	9.897443	15		37	
24	51	9.787883	10.212117	9.890465	10.109535	10.102582	9.897418	9		36	
25	15	9.787923	10.212077	9.890530	10.109470	10.102607	9.897393	45		35	
26	30	9.787964	10.212036	9.890595	10.109405	10.102631	9.897369	30		34	
27	45	9.788005	10.211995	9.890660	10.109340	10.102656	9.897344	15		33	
28	52	9.788045	10.211955	9.890725	10.109275	10.102680	9.897320	8		32	
29	15	9.788086	10.211914	9.890791	10.109209	10.102705	9.897295	45		31	
30	30	9.788126	10.211874	9.890856	10.109144	10.102729	9.897271	30		30	
31	45	9.788167	10.211833	9.890921	10.109079	10.102754	9.897246	15		29	
32	53	9.788208	10.211792	9.890986	10.109014	10.102778	9.897222	7		28	
33	15	9.788248	10.211752	9.891051	10.108949	10.102803	9.897197	45		27	
34	30	9.788289	10.211711	9.891116	10.108884	10.102828	9.897172	30		26	
35	45	9.788329	10.211671	9.891182	10.108818	10.102852	9.897148	15		25	
36	54	9.788370	10.211630	9.891247	10.108753	10.102877	9.897123	6		24	
37	15	9.788411	10.211589	9.891312	10.108688	10.102901	9.897099	45		23	
38	30	9.788451	10.211549	9.891377	10.108623	10.102926	9.897074	30		22	
39	45	9.788492	10.211508	9.891442	10.108558	10.102951	9.897049	15		21	
40	55	9.788532	10.211468	9.891507	10.108493	10.102975	9.897025	5		20	
41	15	9.788573	10.211427	9.891572	10.108428	10.103000	9.897000	45		19	
42	30	9.788613	10.211387	9.891638	10.108362	10.103024	9.896976	30		18	
43	45	9.788654	10.211346	9.891703	10.108297	10.103049	9.896951	15		17	
44	56	9.788694	10.211306	9.891768	10.108232	10.103074	9.896926	4		16	
45	15	9.788735	10.211265	9.891833	10.108167	10.103098	9.896902	45		15	
46	30	9.788775	10.211225	9.891898	10.108102	10.103123	9.896877	30		14	
47	45	9.788816	10.211184	9.891963	10.108037	10.103147	9.896853	15		13	
48	57	9.788856	10.211144	9.892028	10.107972	10.103172	9.896828	3		12	
49	15	9.788897	10.211103	9.892094	10.107906	10.103197	9.896803	45		11	
50	30	9.788937	10.211063	9.892159	10.107841	10.103221	9.896779	30		10	
51	45	9.788978	10.211022	9.892224	10.107776	10.103246	9.896754	15		9	
52	58	9.789018	10.210982	9.892289	10.107711	10.103271	9.896729	2		8	
53	15	9.789059	10.210941	9.892354	10.107646	10.103295	9.896705	45		7	
54	30	9.789099	10.210901	9.892419	10.107581	10.103320	9.896680	30		6	
55	45	9.789140	10.210860	9.892484	10.107516	10.103345	9.896655	15		5	
56	59	9.789180	10.210820	9.892549	10.107451	10.103369	9.896631	1		4	
57	15	9.789221	10.210779	9.892614	10.107386	10.103394	9.896606	45		3	
58	30	9.789261	10.210739	9.892680	10.107320	10.103419	9.896581	30		2	
59	45	9.789302	10.210698	9.892745	10.107255	10.103443	9.896557	15		1	
60	0	9.789342	10.210658	9.892810	10.107190	10.103468	9.896532	0		0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.	
3 ^h 28 ^m .			LOG. SINES, &c.				52 deg.				

2 ^h 32 ^m .		LOG. SINES, &c. (t.)						38 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.789342	10.210658	9.892810	10.107190	10.103463	9.896532	60	60
1	15	9.789382	10.210618	9.892875	10.107125	10.103493	9.896507	45	59
2	30	9.789423	10.210577	9.892940	10.107060	10.103517	9.896483	30	58
3	45	9.789463	10.210537	9.893005	10.106995	10.103542	9.896458	15	57
4	1	9.789504	10.210496	9.893070	10.106930	10.103567	9.896433	59	56
5	15	9.789544	10.210456	9.893135	10.106865	10.103600	9.896409	45	55
6	30	9.789584	10.210416	9.893200	10.106800	10.103616	9.896384	30	54
7	45	9.789625	10.210375	9.893265	10.106735	10.103641	9.896359	15	53
8	2	9.789665	10.210335	9.893331	10.106669	10.103665	9.896335	58	52
9	15	9.789706	10.210294	9.893396	10.106604	10.103690	9.896310	45	51
10	30	9.789746	10.210254	9.893461	10.106539	10.103715	9.896285	30	50
11	45	9.789786	10.210214	9.893526	10.106474	10.103740	9.896260	15	49
12	3	9.789827	10.210173	9.893591	10.106409	10.103764	9.896236	57	48
13	15	9.789867	10.210133	9.893656	10.106344	10.103789	9.896211	45	47
14	30	9.789907	10.210093	9.893721	10.106279	10.103814	9.896186	30	46
15	45	9.789948	10.210052	9.893786	10.106214	10.103838	9.896162	15	45
16	4	9.789988	10.210012	9.893851	10.106149	10.103863	9.896137	56	44
17	15	9.790028	10.209972	9.893916	10.106084	10.103888	9.896112	45	43
18	30	9.790069	10.209931	9.893981	10.106019	10.103913	9.896087	30	42
19	45	9.790109	10.209891	9.894046	10.105954	10.103937	9.896063	15	41
20	5	9.790149	10.209851	9.894111	10.105889	10.103962	9.896038	55	40
21	15	9.790190	10.209810	9.894176	10.105824	10.103987	9.896013	45	39
22	30	9.790230	10.209770	9.894241	10.105759	10.104012	9.895988	30	38
23	45	9.790270	10.209730	9.894306	10.105694	10.104036	9.895963	15	37
24	6	9.790310	10.209690	9.894371	10.105629	10.104061	9.895939	54	36
25	15	9.790351	10.209649	9.894437	10.105563	10.104086	9.895914	45	35
26	30	9.790391	10.209609	9.894502	10.105498	10.104111	9.895889	30	34
27	45	9.790431	10.209569	9.894567	10.105433	10.104135	9.895865	15	33
28	7	9.790471	10.209529	9.894632	10.105368	10.104160	9.895840	53	32
29	15	9.790512	10.209488	9.894697	10.105303	10.104185	9.895815	45	31
30	30	9.790552	10.209448	9.894762	10.105238	10.104210	9.895790	30	30
31	45	9.790592	10.209408	9.894827	10.105173	10.104235	9.895765	15	29
32	8	9.790632	10.209368	9.894892	10.105108	10.104259	9.895741	52	28
33	15	9.790673	10.209327	9.894957	10.105043	10.104284	9.895716	45	27
34	30	9.790713	10.209287	9.895022	10.104978	10.104309	9.895691	30	26
35	45	9.790753	10.209247	9.895087	10.104913	10.104334	9.895666	15	25
36	9	9.790793	10.209207	9.895152	10.104848	10.104359	9.895641	51	24
37	15	9.790833	10.209167	9.895217	10.104783	10.104383	9.895617	45	23
38	30	9.790874	10.209126	9.895282	10.104718	10.104408	9.895592	30	22
39	45	9.790914	10.209086	9.895347	10.104653	10.104433	9.895567	15	21
40	10	9.790954	10.209046	9.895412	10.104588	10.104458	9.895542	50	20
41	15	9.790994	10.209006	9.895477	10.104523	10.104483	9.895517	45	19
42	30	9.791034	10.208966	9.895542	10.104458	10.104508	9.895492	30	18
43	45	9.791075	10.208925	9.895607	10.104393	10.104532	9.895468	15	17
44	11	9.791115	10.208885	9.895672	10.104328	10.104557	9.895443	49	16
45	15	9.791155	10.208845	9.895737	10.104263	10.104582	9.895418	45	15
46	30	9.791195	10.208805	9.895802	10.104198	10.104607	9.895393	30	14
47	45	9.791235	10.208765	9.895867	10.104133	10.104632	9.895368	15	13
48	12	9.791275	10.208725	9.895932	10.104068	10.104657	9.895343	48	12
49	15	9.791315	10.208685	9.895997	10.104003	10.104681	9.895319	45	11
50	30	9.791356	10.208644	9.896062	10.103938	10.104706	9.895294	30	10
51	45	9.791396	10.208604	9.896127	10.103873	10.104731	9.895269	15	9
52	13	9.791436	10.208564	9.896192	10.103808	10.104756	9.895244	47	8
53	15	9.791476	10.208524	9.896257	10.103743	10.104781	9.895219	45	7
54	30	9.791516	10.208484	9.896322	10.103678	10.104806	9.895194	30	6
55	45	9.791556	10.208444	9.896387	10.103613	10.104831	9.895169	15	5
56	14	9.791596	10.208404	9.896452	10.103548	10.104856	9.895144	46	4
57	15	9.791636	10.208364	9.896517	10.103483	10.104880	9.895120	45	3
58	30	9.791676	10.208324	9.896582	10.103418	10.104905	9.895095	30	2
59	45	9.791716	10.208284	9.896647	10.103353	10.104930	9.895070	15	1
60	15	9.791757	10.208243	9.896712	10.103288	10.104955	9.895045	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 27 ^m .		LOG. SINES, &c.						51 deg.	

2 ^h 33 ^m .		LOG. SINES, &c. (t.)						38 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.791757	10.208243	9.896712	10.103288	10.104955	9.895045	45	60
1	15	9.791797	10.208203	9.896777	10.103223	10.104980	9.895020	45	59
2	30	9.791837	10.208163	9.896841	10.103159	10.105005	9.894995	30	58
3	45	9.791877	10.208123	9.896906	10.103094	10.105030	9.894970	15	57
4	16	9.791917	10.208083	9.896971	10.103029	10.105055	9.894945	44	56
5	15	9.791957	10.208043	9.897036	10.102964	10.105080	9.894920	45	55
6	30	9.791997	10.208003	9.897101	10.102899	10.105105	9.894895	30	54
7	45	9.792037	10.207963	9.897166	10.102834	10.105129	9.894871	15	53
8	17	9.792077	10.207923	9.897231	10.102769	10.105154	9.894846	43	52
9	15	9.792117	10.207883	9.897296	10.102704	10.105179	9.894821	45	51
10	30	9.792157	10.207843	9.897361	10.102639	10.105204	9.894796	30	50
11	45	9.792197	10.207803	9.897426	10.102574	10.105229	9.894771	15	49
12	18	9.792237	10.207763	9.897491	10.102509	10.105254	9.894746	42	48
13	15	9.792277	10.207723	9.897556	10.102444	10.105279	9.894721	45	47
14	30	9.792317	10.207683	9.897621	10.102379	10.105304	9.894696	30	46
15	45	9.792357	10.207643	9.897686	10.102314	10.105329	9.894671	15	45
16	19	9.792397	10.207603	9.897751	10.102249	10.105354	9.894646	41	44
17	15	9.792437	10.207563	9.897816	10.102184	10.105379	9.894621	45	43
18	30	9.792477	10.207523	9.897880	10.102120	10.105404	9.894596	30	42
19	45	9.792517	10.207483	9.897945	10.102055	10.105429	9.894571	15	41
20	20	9.792557	10.207443	9.898010	10.101990	10.105454	9.894546	40	40
21	15	9.792597	10.207403	9.898075	10.101925	10.105479	9.894521	45	39
22	30	9.792636	10.207364	9.898140	10.101860	10.105504	9.894496	30	38
23	45	9.792676	10.207324	9.898205	10.101795	10.105529	9.894471	15	37
24	21	9.792716	10.207284	9.898270	10.101730	10.105554	9.894446	39	36
25	15	9.792756	10.207244	9.898335	10.101665	10.105579	9.894421	45	35
26	30	9.792796	10.207204	9.898400	10.101600	10.105604	9.894396	30	34
27	45	9.792836	10.207164	9.898465	10.101535	10.105629	9.894371	15	33
28	22	9.792876	10.207124	9.898530	10.101470	10.105654	9.894346	38	32
29	15	9.792916	10.207084	9.898594	10.101406	10.105679	9.894321	45	31
30	30	9.792956	10.207044	9.898659	10.101341	10.105704	9.894296	30	30
31	45	9.792996	10.207004	9.898724	10.101276	10.105729	9.894271	15	29
32	23	9.793035	10.206965	9.898789	10.101211	10.105754	9.894246	37	28
33	15	9.793075	10.206925	9.898854	10.101146	10.105779	9.894221	45	27
34	30	9.793115	10.206885	9.898919	10.101081	10.105804	9.894196	30	26
35	45	9.793155	10.206845	9.898984	10.101016	10.105829	9.894171	15	25
36	24	9.793195	10.206805	9.899049	10.100951	10.105854	9.894146	36	24
37	15	9.793235	10.206765	9.899114	10.100886	10.105879	9.894121	45	23
38	30	9.793275	10.206725	9.899178	10.100822	10.105904	9.894096	30	22
39	45	9.793314	10.206686	9.899243	10.100757	10.105929	9.894071	15	21
40	25	9.793354	10.206646	9.899308	10.100692	10.105954	9.894046	35	20
41	15	9.793394	10.206606	9.899373	10.100627	10.105979	9.894021	45	19
42	30	9.793434	10.206566	9.899438	10.100562	10.106004	9.893996	30	18
43	45	9.793474	10.206526	9.899503	10.100497	10.106029	9.893971	15	17
44	26	9.793513	10.206487	9.899568	10.100432	10.106054	9.893946	34	16
45	15	9.793553	10.206447	9.899632	10.100368	10.106079	9.893921	45	15
46	30	9.793593	10.206407	9.899697	10.100303	10.106104	9.893896	30	14
47	45	9.793633	10.206367	9.899762	10.100238	10.106129	9.893871	15	13
48	27	9.793673	10.206327	9.899827	10.100173	10.106154	9.893846	33	12
49	15	9.793712	10.206288	9.899892	10.100108	10.106180	9.893820	45	11
50	30	9.793752	10.206248	9.899957	10.100043	10.106205	9.893795	30	10
51	45	9.793792	10.206208	9.900022	10.099978	10.106230	9.893770	15	9
52	28	9.793832	10.206168	9.900086	10.099914	10.106255	9.893745	32	8
53	15	9.793871	10.206129	9.900151	10.099849	10.106280	9.893720	45	7
54	30	9.793911	10.206089	9.900216	10.099784	10.106305	9.893695	30	6
55	45	9.793951	10.206049	9.900281	10.099719	10.106330	9.893670	15	5
56	29	9.793991	10.206009	9.900346	10.099654	10.106355	9.893645	31	4
57	15	9.794030	10.205970	9.900411	10.099589	10.106380	9.893620	45	3
58	30	9.794070	10.205930	9.900475	10.099525	10.106405	9.893595	30	2
59	45	9.794110	10.205890	9.900540	10.099460	10.106431	9.893569	15	1
60	30	9.794150	10.205850	9.900605	10.099395	10.106456	9.893544	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 26 ^m .		LOG. SINES, &c.						51 deg.	

2 ^h 34 ^m .		LOG. SINES, &c. (t.)						38 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.
0	30	9.794150	10.205850	9.900605	10.099395	10.106456	9.893544	30		60
1	15	9.794189	10.205811	9.900670	10.099330	10.106481	9.893519	45		59
2	30	9.794229	10.205771	9.900735	10.099265	10.106506	9.893494	30		58
3	45	9.794269	10.205731	9.900800	10.099200	10.106531	9.893469	15		57
4	31	9.794308	10.205692	9.900864	10.099136	10.106556	9.893443		29	56
5	15	9.794348	10.205652	9.900929	10.099071	10.106581	9.893419	45		55
6	30	9.794388	10.205612	9.900994	10.099006	10.106606	9.893394	30		54
7	45	9.794427	10.205573	9.901059	10.098941	10.106632	9.893368	15		53
8	32	9.794467	10.205533	9.901124	10.098876	10.106657	9.893343		28	52
9	15	9.794507	10.205493	9.901189	10.098811	10.106682	9.893318	45		51
10	30	9.794546	10.205454	9.901253	10.098747	10.106707	9.893293	30		50
11	45	9.794586	10.205414	9.901318	10.098682	10.106732	9.893268	15		49
12	33	9.794626	10.205374	9.901383	10.098617	10.106757	9.893242		27	48
13	15	9.794665	10.205335	9.901448	10.098552	10.106783	9.893217	45		47
14	30	9.794705	10.205295	9.901513	10.098487	10.106808	9.893192	30		46
15	45	9.794744	10.205256	9.901577	10.098423	10.106833	9.893167	15		45
16	34	9.794784	10.205216	9.901642	10.098358	10.106858	9.893142		26	44
17	15	9.794824	10.205176	9.901707	10.098293	10.106883	9.893117	45		43
18	30	9.794863	10.205137	9.901772	10.098228	10.106908	9.893092	30		42
19	45	9.794903	10.205097	9.901836	10.098164	10.106934	9.893066	15		41
20	35	9.794942	10.205058	9.901901	10.098099	10.106959	9.893041		25	40
21	15	9.794982	10.205018	9.901966	10.098034	10.106984	9.893016	45		39
22	30	9.795022	10.204978	9.902031	10.097969	10.107009	9.892991	30		38
23	45	9.795061	10.204939	9.902096	10.097904	10.107034	9.892966	15		37
24	36	9.795101	10.204899	9.902160	10.097840	10.107060	9.892940		24	36
25	15	9.795140	10.204860	9.902225	10.097775	10.107085	9.892915	45		35
26	30	9.795180	10.204820	9.902290	10.097710	10.107110	9.892890	30		34
27	45	9.795219	10.204781	9.902355	10.097645	10.107135	9.892865	15		33
28	37	9.795259	10.204741	9.902419	10.097581	10.107161	9.892839		23	32
29	15	9.795298	10.204702	9.902484	10.097516	10.107186	9.892814	45		31
30	30	9.795338	10.204662	9.902549	10.097451	10.107211	9.892789	30		30
31	45	9.795378	10.204622	9.902614	10.097386	10.107236	9.892764	15		29
32	38	9.795417	10.204583	9.902679	10.097321	10.107262	9.892738		22	28
33	15	9.795457	10.204543	9.902743	10.097257	10.107287	9.892713	45		27
34	30	9.795496	10.204504	9.902808	10.097192	10.107312	9.892688	30		26
35	45	9.795536	10.204464	9.902873	10.097127	10.107337	9.892663	15		25
36	39	9.795575	10.204425	9.902938	10.097062	10.107363	9.892637		21	24
37	15	9.795615	10.204385	9.903002	10.096998	10.107388	9.892612	45		23
38	30	9.795654	10.204346	9.903067	10.096933	10.107413	9.892587	30		22
39	45	9.795694	10.204306	9.903132	10.096868	10.107438	9.892562	15		21
40	40	9.795733	10.204267	9.903197	10.096803	10.107464	9.892536		20	20
41	15	9.795772	10.204228	9.903261	10.096739	10.107489	9.892511	45		19
42	30	9.795812	10.204188	9.903326	10.096674	10.107514	9.892486	30		18
43	45	9.795851	10.204149	9.903391	10.096609	10.107539	9.892461	15		17
44	41	9.795891	10.204109	9.903455	10.096545	10.107565	9.892435		19	16
45	15	9.795930	10.204070	9.903520	10.096480	10.107590	9.892410	45		15
46	30	9.795970	10.204030	9.903585	10.096415	10.107615	9.892385	30		14
47	45	9.796009	10.203991	9.903650	10.096350	10.107641	9.892359	15		13
48	42	9.796049	10.203951	9.903714	10.096286	10.107666	9.892334		18	12
49	15	9.796088	10.203912	9.903779	10.096221	10.107691	9.892309	45		11
50	30	9.796127	10.203873	9.903844	10.096156	10.107716	9.892284	30		10
51	45	9.796167	10.203833	9.903909	10.096091	10.107742	9.892258	15		9
52	43	9.796206	10.203794	9.903973	10.096027	10.107767	9.892233		17	8
53	15	9.796246	10.203754	9.904038	10.095962	10.107792	9.892208	45		7
54	30	9.796285	10.203715	9.904103	10.095897	10.107818	9.892182	30		6
55	45	9.796324	10.203676	9.904167	10.095833	10.107843	9.892157	15		5
56	44	9.796364	10.203636	9.904232	10.095768	10.107868	9.892132		16	4
57	15	9.796403	10.203597	9.904297	10.095703	10.107894	9.892106	45		3
58	30	9.796442	10.203558	9.904362	10.095638	10.107919	9.892081	30		2
59	45	9.796482	10.203518	9.904426	10.095574	10.107944	9.892056	15		1
60	45	9.796521	10.203479	9.904491	10.095509	10.107970	9.892030		15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.
3 ^h 25 ^m .		LOG. SINES, &c.						51 deg.		

2 ^h 35 ^m .		LOG. SINES, &c. (t.)						38 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.796521	10.203479	9.904491	10.095509	10.107970	9.892030	15	60
1	15	9.796561	10.203439	9.904556	10.095444	10.107995	9.892005	45	59
2	30	9.796600	10.203400	9.904620	10.095380	10.108020	9.891980	30	58
3	45	9.796639	10.203361	9.904685	10.095315	10.108046	9.891954	15	57
4	46	9.796679	10.203321	9.904750	10.095250	10.108071	9.891929	14	56
5	15	9.796718	10.203282	9.904814	10.095186	10.108097	9.891903	45	55
6	30	9.796757	10.203243	9.904879	10.095121	10.108122	9.891878	30	54
7	45	9.796797	10.203203	9.904944	10.095056	10.108147	9.891853	15	53
8	47	9.796886	10.203164	9.905008	10.094992	10.108173	9.891827	13	52
9	15	9.796875	10.203125	9.905073	10.094927	10.108198	9.891802	45	51
10	30	9.796914	10.203086	9.905138	10.094862	10.108223	9.891777	30	50
11	45	9.796954	10.203046	9.905202	10.094798	10.108249	9.891751	15	49
12	48	9.796993	10.203007	9.905267	10.094733	10.108274	9.891726	12	48
13	15	9.797032	10.202968	9.905332	10.094668	10.108300	9.891700	45	47
14	30	9.797072	10.202928	9.905396	10.094604	10.108325	9.891675	30	46
15	45	9.797111	10.202889	9.905461	10.094539	10.108350	9.891650	15	45
16	49	9.797150	10.202850	9.905526	10.094474	10.108376	9.891624	11	44
17	15	9.797189	10.202811	9.905590	10.094410	10.108401	9.891599	45	43
18	30	9.797229	10.202771	9.905655	10.094345	10.108427	9.891573	30	42
19	45	9.797268	10.202732	9.905720	10.094280	10.108452	9.891548	15	41
20	50	9.797307	10.202693	9.905784	10.094216	10.108477	9.891523	10	40
21	15	9.797346	10.202654	9.905849	10.094151	10.108503	9.891497	45	39
22	30	9.797386	10.202614	9.905914	10.094086	10.108528	9.891472	30	38
23	45	9.797425	10.202575	9.905978	10.094022	10.108554	9.891446	15	37
24	51	9.797464	10.202536	9.906043	10.093957	10.108579	9.891421	9	36
25	15	9.797503	10.202497	9.906108	10.093892	10.108605	9.891395	45	35
26	30	9.797542	10.202458	9.906172	10.093828	10.108630	9.891370	30	34
27	45	9.797582	10.202418	9.906237	10.093763	10.108656	9.891344	15	33
28	52	9.797621	10.202379	9.906302	10.093698	10.108681	9.891319	8	32
29	15	9.797660	10.202340	9.906366	10.093634	10.108706	9.891294	45	31
30	30	9.797699	10.202301	9.906431	10.093569	10.108732	9.891268	30	30
31	45	9.797738	10.202262	9.906496	10.093504	10.108757	9.891243	15	29
32	53	9.797777	10.202223	9.906560	10.093440	10.108783	9.891217	7	28
33	15	9.797817	10.202183	9.906625	10.093375	10.108808	9.891192	45	27
34	30	9.797856	10.202144	9.906689	10.093311	10.108834	9.891166	30	26
35	45	9.797895	10.202105	9.906754	10.093246	10.108859	9.891141	15	25
36	54	9.797934	10.202066	9.906819	10.093181	10.108885	9.891115	6	24
37	15	9.797973	10.202027	9.906883	10.093117	10.108910	9.891090	45	23
38	30	9.798012	10.201988	9.906948	10.093052	10.108936	9.891064	30	22
39	45	9.798051	10.201949	9.907013	10.092987	10.108961	9.891039	15	21
40	55	9.798091	10.201909	9.907077	10.092923	10.108987	9.891013	5	20
41	15	9.798130	10.201870	9.907142	10.092858	10.109012	9.890988	45	19
42	30	9.798169	10.201831	9.907206	10.092794	10.109038	9.890962	30	18
43	45	9.798208	10.201792	9.907271	10.092729	10.109063	9.890937	15	17
44	56	9.798247	10.201753	9.907336	10.092664	10.109089	9.890911	4	16
45	15	9.798286	10.201714	9.907400	10.092600	10.109114	9.890886	45	15
46	30	9.798325	10.201675	9.907465	10.092535	10.109140	9.890860	30	14
47	45	9.798364	10.201636	9.907529	10.092471	10.109165	9.890835	15	13
48	57	9.798403	10.201597	9.907594	10.092406	10.109191	9.890809	3	12
49	15	9.798442	10.201558	9.907659	10.092341	10.109216	9.890784	45	11
50	30	9.798481	10.201519	9.907723	10.092277	10.109242	9.890758	30	10
51	45	9.798521	10.201479	9.907788	10.092212	10.109267	9.890733	15	9
52	58	9.798560	10.201440	9.907852	10.092148	10.109293	9.890707	2	8
53	15	9.798599	10.201401	9.907917	10.092083	10.109319	9.890681	45	7
54	30	9.798638	10.201362	9.907982	10.092018	10.109344	9.890656	30	6
55	45	9.798677	10.201323	9.908046	10.091954	10.109370	9.890630	15	5
56	59	9.798716	10.201284	9.908111	10.091889	10.109395	9.890605	1	4
57	15	9.798755	10.201245	9.908175	10.091825	10.109421	9.890579	45	3
58	30	9.798794	10.201206	9.908240	10.091760	10.109446	9.890554	30	2
59	45	9.798833	10.201167	9.908305	10.091695	10.109472	9.890528	15	1
60	60	9.798872	10.201128	9.908369	10.091631	10.109497	9.890503	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 24 ^m .		LOG. SINES, &c.						51 deg.	

2 ^h 36 ^m .		LOG. SINES, &c. (t.)						39 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.798872	10.201128	9.908369	10.091631	10.109497	9.890503	60	60
1	15	9.798911	10.201089	9.908434	10.091566	10.109523	9.890477	45	59
2	30	9.798950	10.201050	9.908498	10.091502	10.109549	9.890451	30	58
3	45	9.798989	10.201011	9.908563	10.091437	10.109574	9.890426	15	57
4	1	9.799028	10.200972	9.908627	10.091373	10.109600	9.890400	59	56
5	15	9.799067	10.200933	9.908692	10.091308	10.109625	9.890375	45	55
6	30	9.799106	10.200894	9.908757	10.091243	10.109651	9.890349	30	54
7	45	9.799145	10.200855	9.908821	10.091179	10.109677	9.890323	15	53
8	2	9.799184	10.200816	9.908886	10.091114	10.109702	9.890298	58	52
9	15	9.799223	10.200777	9.908950	10.091050	10.109728	9.890272	45	51
10	30	9.799261	10.200739	9.909015	10.090985	10.109753	9.890247	30	50
11	45	9.799300	10.200700	9.909079	10.090921	10.109779	9.890221	15	49
12	3	9.799339	10.200661	9.909144	10.090856	10.109805	9.890195	57	48
13	15	9.799378	10.200622	9.909208	10.090792	10.109830	9.890170	45	47
14	30	9.799417	10.200583	9.909273	10.090727	10.109856	9.890144	30	46
15	45	9.799456	10.200544	9.909338	10.090662	10.109882	9.890118	15	45
16	4	9.799495	10.200505	9.909402	10.090598	10.109907	9.890093	56	44
17	15	9.799534	10.200466	9.909467	10.090533	10.109933	9.890067	45	43
18	30	9.799573	10.200427	9.909531	10.090469	10.109958	9.890042	30	42
19	45	9.799612	10.200388	9.909596	10.090404	10.109984	9.890016	15	41
20	5	9.799651	10.200349	9.909660	10.090340	10.110010	9.889990	55	40
21	15	9.799690	10.200310	9.909725	10.090275	10.110035	9.889965	45	39
22	30	9.799728	10.200272	9.909789	10.090211	10.110061	9.889939	30	38
23	45	9.799767	10.200233	9.909854	10.090146	10.110087	9.889913	15	37
24	6	9.799806	10.200194	9.909918	10.090082	10.110112	9.889888	54	36
25	15	9.799845	10.200155	9.909983	10.090017	10.110138	9.889862	45	35
26	30	9.799884	10.200116	9.910047	10.089953	10.110164	9.889836	30	34
27	45	9.799923	10.200077	9.910112	10.089888	10.110189	9.889811	15	33
28	7	9.799962	10.200038	9.910177	10.089823	10.110215	9.889785	53	32
29	15	9.800000	10.200000	9.910241	10.089759	10.110241	9.889759	45	31
30	30	9.800039	10.199961	9.910306	10.089694	10.110266	9.889734	30	30
31	45	9.800078	10.199922	9.910370	10.089630	10.110292	9.889708	15	29
32	8	9.800117	10.199883	9.910435	10.089565	10.110318	9.889682	52	28
33	15	9.800156	10.199844	9.910499	10.089501	10.110344	9.889656	45	27
34	30	9.800194	10.199806	9.910564	10.089436	10.110369	9.889631	30	26
35	45	9.800233	10.199767	9.910628	10.089372	10.110395	9.889605	15	25
36	9	9.800272	10.199728	9.910693	10.089307	10.110421	9.889579	51	24
37	15	9.800311	10.199689	9.910757	10.089243	10.110446	9.889554	45	23
38	30	9.800350	10.199650	9.910822	10.089178	10.110472	9.889528	30	22
39	45	9.800388	10.199612	9.910886	10.089114	10.110498	9.889502	15	21
40	10	9.800427	10.199573	9.910951	10.089049	10.110524	9.889476	50	20
41	15	9.800466	10.199534	9.911015	10.088985	10.110549	9.889451	45	19
42	30	9.800505	10.199495	9.911080	10.088920	10.110575	9.889425	30	18
43	45	9.800543	10.199457	9.911144	10.088856	10.110601	9.889399	15	17
44	11	9.800582	10.199418	9.911209	10.088791	10.110626	9.889374	49	16
45	15	9.800621	10.199379	9.911273	10.088727	10.110652	9.889348	45	15
46	30	9.800660	10.199340	9.911338	10.088662	10.110678	9.889322	30	14
47	45	9.800698	10.199302	9.911402	10.088598	10.110704	9.889296	15	13
48	12	9.800737	10.199263	9.911467	10.088533	10.110729	9.889271	48	12
49	15	9.800776	10.199224	9.911531	10.088469	10.110755	9.889245	45	11
50	30	9.800815	10.199185	9.911596	10.088404	10.110781	9.889219	30	10
51	45	9.800853	10.199147	9.911660	10.088340	10.110807	9.889193	15	9
52	13	9.800892	10.199108	9.911724	10.088276	10.110833	9.889167	47	8
53	15	9.800931	10.199069	9.911789	10.088211	10.110858	9.889142	45	7
54	30	9.800969	10.199031	9.911853	10.088147	10.110884	9.889116	30	6
55	45	9.801008	10.198992	9.911918	10.088082	10.110910	9.889090	15	5
56	14	9.801047	10.198953	9.911982	10.088018	10.110936	9.889064	46	4
57	15	9.801085	10.198915	9.912047	10.087953	10.110961	9.889039	45	3
58	30	9.801124	10.198876	9.912111	10.087889	10.110987	9.889013	30	2
59	45	9.801163	10.198837	9.912176	10.087824	10.111013	9.888987	15	1
60	15	9.801201	10.198799	9.912240	10.087760	10.111039	9.888961	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 23 ^m .		LOG. SINES, &c.						50 deg.	

2 ^h 37 ^m .		LOG. SINES, &c. (t.)						39 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.801201	10.198799	9.912240	10.087760	10.111039	9.888961	45	60
1	15	9.801240	10.198760	9.912305	10.087695	10.111065	9.888935	45	59
2	30	9.801279	10.198721	9.912369	10.087631	10.111090	9.888910	30	58
3	45	9.801317	10.198683	9.912434	10.087566	10.111116	9.888884	15	57
4	16	9.801356	10.198644	9.912498	10.087502	10.111142	9.888858	44	56
5	15	9.801395	10.198605	9.912562	10.087438	10.111168	9.888832	45	55
6	30	9.801433	10.198567	9.912627	10.087373	10.111194	9.888806	30	54
7	45	9.801472	10.198528	9.912691	10.087309	10.111220	9.888780	15	53
8	17	9.801511	10.198489	9.912756	10.087244	10.111245	9.888755	43	52
9	15	9.801549	10.198451	9.912820	10.087180	10.111271	9.888729	45	51
10	30	9.801588	10.198412	9.912885	10.087115	10.111297	9.888703	30	50
11	45	9.801626	10.198374	9.912949	10.087051	10.111323	9.888677	15	49
12	18	9.801665	10.198335	9.913014	10.086986	10.111349	9.888651	42	48
13	15	9.801703	10.198297	9.913078	10.086922	10.111375	9.888625	45	47
14	30	9.801742	10.198258	9.913142	10.086858	10.111400	9.888600	30	46
15	45	9.801781	10.198219	9.913207	10.086793	10.111426	9.888574	15	45
16	19	9.801819	10.198181	9.913271	10.086729	10.111452	9.888548	41	44
17	15	9.801858	10.198142	9.913336	10.086664	10.111478	9.888522	45	43
18	30	9.801896	10.198104	9.913400	10.086600	10.111503	9.888496	30	42
19	45	9.801935	10.198065	9.913465	10.086535	10.111530	9.888470	15	41
20	20	9.801973	10.198027	9.913529	10.086471	10.111556	9.888444	40	40
21	15	9.802012	10.197988	9.913593	10.086407	10.111582	9.888418	45	39
22	30	9.802050	10.197950	9.913658	10.086342	10.111607	9.888393	30	38
23	45	9.802089	10.197911	9.913722	10.086278	10.111633	9.888367	15	37
24	21	9.802128	10.197872	9.913787	10.086213	10.111659	9.888341	39	36
25	15	9.802166	10.197834	9.913851	10.086149	10.111685	9.888315	45	35
26	30	9.802205	10.197795	9.913916	10.086084	10.111711	9.888289	30	34
27	45	9.802243	10.197757	9.913980	10.086020	10.111737	9.888263	15	33
28	22	9.802282	10.197718	9.914044	10.085956	10.111763	9.888237	38	32
29	15	9.802320	10.197680	9.914109	10.085891	10.111789	9.888211	45	31
30	30	9.802359	10.197641	9.914173	10.085827	10.111815	9.888185	30	30
31	45	9.802397	10.197603	9.914238	10.085762	10.111841	9.888159	15	29
32	23	9.802435	10.197565	9.914302	10.085698	10.111867	9.888133	37	28
33	15	9.802474	10.197526	9.914366	10.085634	10.111892	9.888108	45	27
34	30	9.802512	10.197488	9.914431	10.085569	10.111918	9.888082	30	26
35	45	9.802551	10.197449	9.914495	10.085505	10.111944	9.888056	15	25
36	24	9.802589	10.197411	9.914560	10.085440	10.111970	9.888030	36	24
37	15	9.802628	10.197372	9.914624	10.085376	10.111996	9.888004	45	23
38	30	9.802666	10.197334	9.914688	10.085312	10.112022	9.887978	30	22
39	45	9.802705	10.197295	9.914753	10.085247	10.112048	9.887952	15	21
40	25	9.802743	10.197257	9.914817	10.085183	10.112074	9.887926	35	20
41	15	9.802782	10.197218	9.914881	10.085119	10.112100	9.887900	45	19
42	30	9.802820	10.197180	9.914946	10.085054	10.112126	9.887874	30	18
43	45	9.802858	10.197142	9.915010	10.084990	10.112152	9.887848	15	17
44	26	9.802897	10.197103	9.915075	10.084925	10.112178	9.887822	34	16
45	15	9.802935	10.197065	9.915139	10.084861	10.112204	9.887796	45	15
46	30	9.802974	10.197026	9.915203	10.084797	10.112230	9.887770	30	14
47	45	9.803012	10.196988	9.915268	10.084732	10.112256	9.887744	15	13
48	27	9.803050	10.196950	9.915332	10.084668	10.112282	9.887718	33	12
49	15	9.803089	10.196911	9.915396	10.084604	10.112308	9.887692	45	11
50	30	9.803127	10.196873	9.915461	10.084539	10.112334	9.887666	30	10
51	45	9.803165	10.196835	9.915525	10.084475	10.112360	9.887640	15	9
52	28	9.803204	10.196796	9.915590	10.084410	10.112386	9.887614	32	8
53	15	9.803242	10.196758	9.915654	10.084346	10.112412	9.887588	45	7
54	30	9.803280	10.196720	9.915718	10.084282	10.112438	9.887562	30	6
55	45	9.803319	10.196681	9.915783	10.084217	10.112464	9.887536	15	5
56	29	9.803357	10.196643	9.915847	10.084153	10.112490	9.887510	31	4
57	15	9.803396	10.196604	9.915911	10.084089	10.112516	9.887484	45	3
58	30	9.803434	10.196566	9.915976	10.084024	10.112542	9.887458	30	2
59	45	9.803472	10.196528	9.916040	10.083960	10.112568	9.887432	15	1
60	30	9.803510	10.196490	9.916104	10.083896	10.112594	9.887406	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 22 ^m .		LOG. SINES, &c.						50 deg.	

2 ^h 38 ^m . LOG. SINES, &c. (t.)										39 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.		
0	30	9.803510	10.196490	9.916104	10.083896	10.112594	9.887406	30	60		
1	15	9.803549	10.196451	9.916169	10.083831	10.112620	9.887380	45	59		
2	30	9.803587	10.196413	9.916233	10.083767	10.112646	9.887354	30	58		
3	45	9.803625	10.196375	9.916297	10.083703	10.112672	9.887328	15	57		
4	31	9.803664	10.196336	9.916362	10.083638	10.112698	9.887302	29	56		
5	15	9.803702	10.196298	9.916426	10.083574	10.112724	9.887276	45	55		
6	30	9.803740	10.196260	9.916490	10.083510	10.112750	9.887250	30	54		
7	45	9.803779	10.196221	9.916555	10.083445	10.112776	9.887224	15	53		
8	32	9.803817	10.196183	9.916619	10.083381	10.112802	9.887198	28	52		
9	15	9.803855	10.196145	9.916683	10.083317	10.112828	9.887172	45	51		
10	30	9.803893	10.196107	9.916748	10.083252	10.112855	9.887145	30	50		
11	45	9.803932	10.196068	9.916812	10.083188	10.112881	9.887119	15	49		
12	33	9.803970	10.196030	9.916876	10.083124	10.112907	9.887093	27	48		
13	15	9.804008	10.195992	9.916941	10.083059	10.112933	9.887067	45	47		
14	30	9.804046	10.195954	9.917005	10.082995	10.112959	9.887041	30	46		
15	45	9.804085	10.195915	9.917069	10.082931	10.112985	9.887015	15	45		
16	34	9.804123	10.195877	9.917134	10.082866	10.113011	9.886989	26	44		
17	15	9.804161	10.195839	9.917198	10.082802	10.113037	9.886963	45	43		
18	30	9.804199	10.195801	9.917262	10.082738	10.113063	9.886937	30	42		
19	45	9.804237	10.195763	9.917327	10.082673	10.113089	9.886911	15	41		
20	35	9.804276	10.195724	9.917391	10.082609	10.113115	9.886885	25	40		
21	15	9.804314	10.195686	9.917455	10.082545	10.113142	9.886858	45	39		
22	30	9.804352	10.195648	9.917520	10.082480	10.113168	9.886832	30	38		
23	45	9.804390	10.195610	9.917584	10.082416	10.113194	9.886806	15	37		
24	36	9.804428	10.195572	9.917648	10.082352	10.113220	9.886780	24	36		
25	15	9.804467	10.195533	9.917713	10.082287	10.113246	9.886754	45	35		
26	30	9.804505	10.195495	9.917777	10.082223	10.113272	9.886728	30	34		
27	45	9.804543	10.195457	9.917841	10.082159	10.113298	9.886702	15	33		
28	37	9.804581	10.195419	9.917905	10.082095	10.113324	9.886676	23	32		
29	15	9.804619	10.195381	9.917970	10.082030	10.113351	9.886649	45	31		
30	30	9.804657	10.195343	9.918034	10.081966	10.113377	9.886623	30	30		
31	45	9.804695	10.195305	9.918098	10.081902	10.113403	9.886597	15	29		
32	38	9.804734	10.195266	9.918163	10.081837	10.113429	9.886571	22	28		
33	15	9.804772	10.195228	9.918227	10.081773	10.113455	9.886545	45	27		
34	30	9.804810	10.195190	9.918291	10.081709	10.113481	9.886519	30	26		
35	45	9.804848	10.195152	9.918355	10.081645	10.113508	9.886492	15	25		
36	39	9.804886	10.195114	9.918420	10.081580	10.113534	9.886466	21	24		
37	15	9.804924	10.195076	9.918484	10.081516	10.113560	9.886440	45	23		
38	30	9.804962	10.195038	9.918548	10.081452	10.113586	9.886414	30	22		
39	45	9.805000	10.195000	9.918613	10.081387	10.113612	9.886388	15	21		
40	40	9.805038	10.194962	9.918677	10.081323	10.113638	9.886362	20	20		
41	15	9.805077	10.194923	9.918741	10.081259	10.113665	9.886335	45	19		
42	30	9.805115	10.194885	9.918805	10.081195	10.113691	9.886309	30	18		
43	45	9.805153	10.194847	9.918870	10.081130	10.113717	9.886283	15	17		
44	41	9.805191	10.194809	9.918934	10.081066	10.113743	9.886257	19	16		
45	15	9.805229	10.194771	9.918998	10.081002	10.113769	9.886231	45	15		
46	30	9.805267	10.194733	9.919063	10.080937	10.113796	9.886204	30	14		
47	45	9.805305	10.194695	9.919127	10.080873	10.113822	9.886178	15	13		
48	42	9.805343	10.194657	9.919191	10.080809	10.113848	9.886152	18	12		
49	15	9.805381	10.194619	9.919255	10.080745	10.113874	9.886126	45	11		
50	30	9.805419	10.194581	9.919320	10.080680	10.113901	9.886099	30	10		
51	45	9.805457	10.194543	9.919384	10.080616	10.113927	9.886073	15	9		
52	43	9.805495	10.194505	9.919448	10.080552	10.113953	9.886047	17	8		
53	15	9.805533	10.194467	9.919512	10.080488	10.113979	9.886021	45	7		
54	30	9.805571	10.194429	9.919577	10.080423	10.114006	9.885994	30	6		
55	45	9.805609	10.194391	9.919641	10.080359	10.114032	9.885968	15	5		
56	44	9.805647	10.194353	9.919705	10.080295	10.114058	9.885942	16	4		
57	15	9.805685	10.194315	9.919769	10.080231	10.114084	9.885916	45	3		
58	30	9.805723	10.194277	9.919834	10.080166	10.114111	9.885889	30	2		
59	45	9.805761	10.194239	9.919898	10.080102	10.114137	9.885863	15	1		
60	45	9.805799	10.194201	9.919962	10.080038	10.114163	9.885837	15	0		
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.		
3 ^h 21 ^m . LOG. SINES, &c.										50 deg.	

2^h 39^m.

LOG. SINES, &c. (1.)

39 deg.

sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.805799	10.194201	9.919962	10.080038	10.114163	9.885837	15	60
1	15	9.805837	10.194163	9.920026	10.079974	10.114189	9.885811	45	59
2	30	9.805875	10.194125	9.920091	10.079909	10.114216	9.885784	30	58
3	45	9.805913	10.194087	9.920155	10.079845	10.114242	9.885758	15	57
4	46	9.805951	10.194049	9.920219	10.079781	10.114268	9.885732	14	56
5	15	9.805989	10.194011	9.920283	10.079717	10.114294	9.885706	45	55
6	30	9.806027	10.193973	9.920347	10.079653	10.114321	9.885679	30	54
7	45	9.806065	10.193935	9.920412	10.079588	10.114347	9.885653	15	53
8	47	9.806103	10.193897	9.920476	10.079524	10.114373	9.885627	13	52
9	15	9.806141	10.193859	9.920540	10.079460	10.114400	9.885600	45	51
10	30	9.806179	10.193821	9.920604	10.079396	10.114426	9.885574	30	50
11	45	9.806216	10.193784	9.920669	10.079331	10.114452	9.885548	15	49
12	48	9.806254	10.193746	9.920733	10.079267	10.114479	9.885521	12	48
13	15	9.806292	10.193708	9.920797	10.079203	10.114505	9.885495	45	47
14	30	9.806330	10.193670	9.920861	10.079139	10.114531	9.885469	30	46
15	45	9.806368	10.193632	9.920925	10.079075	10.114557	9.885443	15	45
16	49	9.806406	10.193594	9.920990	10.079010	10.114584	9.885416	11	44
17	15	9.806444	10.193556	9.921054	10.078946	10.114610	9.885390	45	43
18	30	9.806482	10.193518	9.921118	10.078882	10.114636	9.885364	30	42
19	45	9.806520	10.193480	9.921182	10.078818	10.114663	9.885337	15	41
20	50	9.806557	10.193443	9.921247	10.078753	10.114689	9.885311	10	40
21	15	9.806595	10.193405	9.921311	10.078689	10.114716	9.885284	45	39
22	30	9.806633	10.193367	9.921375	10.078625	10.114742	9.885258	30	38
23	45	9.806671	10.193329	9.921439	10.078561	10.114768	9.885232	15	37
24	51	9.806709	10.193291	9.921503	10.078497	10.114795	9.885205	9	36
25	15	9.806747	10.193253	9.921568	10.078432	10.114821	9.885179	45	35
26	30	9.806785	10.193215	9.921632	10.078368	10.114847	9.885153	30	34
27	45	9.806822	10.193178	9.921696	10.078304	10.114874	9.885126	15	33
28	52	9.806860	10.193140	9.921760	10.078240	10.114900	9.885100	8	32
29	15	9.806898	10.193102	9.921824	10.078176	10.114926	9.885074	45	31
30	30	9.806936	10.193064	9.921889	10.078111	10.114953	9.885047	30	30
31	45	9.806974	10.193026	9.921953	10.078047	10.114979	9.885021	15	29
32	53	9.807011	10.192989	9.922017	10.077983	10.115006	9.884994	7	28
33	15	9.807049	10.192951	9.922081	10.077919	10.115032	9.884968	45	27
34	30	9.807087	10.192913	9.922145	10.077855	10.115058	9.884942	30	26
35	45	9.807125	10.192875	9.922209	10.077791	10.115085	9.884915	15	25
36	54	9.807163	10.192837	9.922274	10.077726	10.115111	9.884889	6	24
37	15	9.807200	10.192800	9.922338	10.077662	10.115138	9.884862	45	23
38	30	9.807238	10.192762	9.922402	10.077598	10.115164	9.884836	30	22
39	45	9.807276	10.192724	9.922466	10.077534	10.115190	9.884810	15	21
40	55	9.807314	10.192686	9.922530	10.077470	10.115217	9.884783	5	20
41	15	9.807351	10.192649	9.922595	10.077405	10.115243	9.884757	45	19
42	30	9.807389	10.192611	9.922659	10.077341	10.115270	9.884730	30	18
43	45	9.807427	10.192573	9.922723	10.077277	10.115296	9.884704	15	17
44	56	9.807465	10.192535	9.922787	10.077213	10.115323	9.884677	4	16
45	15	9.807502	10.192498	9.922851	10.077149	10.115349	9.884651	45	15
46	30	9.807540	10.192460	9.922915	10.077085	10.115375	9.884625	30	14
47	45	9.807578	10.192422	9.922980	10.077020	10.115402	9.884598	15	13
48	57	9.807615	10.192385	9.923044	10.076956	10.115428	9.884572	3	12
49	15	9.807653	10.192347	9.923108	10.076892	10.115455	9.884545	45	11
50	30	9.807691	10.192309	9.923172	10.076828	10.115481	9.884519	30	10
51	45	9.807728	10.192272	9.923236	10.076764	10.115508	9.884492	15	9
52	58	9.807766	10.192234	9.923300	10.076700	10.115534	9.884466	2	8
53	15	9.807804	10.192196	9.923364	10.076636	10.115561	9.884439	45	7
54	30	9.807842	10.192158	9.923429	10.076571	10.115587	9.884413	30	6
55	45	9.807879	10.192121	9.923493	10.076507	10.115614	9.884386	15	5
56	59	9.807917	10.192083	9.923557	10.076443	10.115640	9.884360	1	4
57	15	9.807955	10.192045	9.923621	10.076379	10.115667	9.884333	45	3
58	30	9.807992	10.192008	9.923685	10.076315	10.115693	9.884307	30	2
59	45	9.808030	10.191970	9.923749	10.076251	10.115720	9.884280	15	1
60	60	9.808067	10.191933	9.923813	10.076187	10.115746	9.884254	0	0

3^h 20^m.

LOG. SINES, &c.

50 deg.

2 ^h 40 ^m .		LOG. SINES, &c. (t.)						40 deg.	
sin.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	(0)	9.808067	10.191933	9.923813	10.076187	10.115746	9.884254	60	60
1	15	9.808105	10.191895	9.923878	10.076122	10.115773	9.884227	45	59
2	30	9.808143	10.191857	9.923942	10.076058	10.115799	9.884201	30	58
3	45	9.808180	10.191820	9.924006	10.075994	10.115826	9.884174	15	57
4	1	9.808218	10.191782	9.924070	10.075930	10.115852	9.884148	59	56
5	15	9.808256	10.191744	9.924134	10.075866	10.115879	9.884121	45	55
6	30	9.808293	10.191707	9.924198	10.075802	10.115905	9.884095	30	54
7	45	9.808331	10.191669	9.924262	10.075738	10.115932	9.884068	15	53
8	2	9.808368	10.191632	9.924327	10.075673	10.115958	9.884042	58	52
9	15	9.808406	10.191594	9.924391	10.075609	10.115985	9.884015	45	51
10	30	9.808444	10.191556	9.924455	10.075545	10.116011	9.883989	30	50
11	45	9.808481	10.191519	9.924519	10.075481	10.116038	9.883962	15	49
12	3	9.808519	10.191481	9.924583	10.075417	10.116064	9.883936	57	48
13	15	9.808556	10.191444	9.924647	10.075353	10.116091	9.883909	45	47
14	30	9.808594	10.191406	9.924711	10.075289	10.116117	9.883883	30	46
15	45	9.808631	10.191369	9.924775	10.075225	10.116144	9.883856	15	45
16	4	9.808669	10.191331	9.924840	10.075160	10.116171	9.883829	56	44
17	15	9.808707	10.191293	9.924904	10.075096	10.116197	9.883803	45	43
18	30	9.808744	10.191256	9.924968	10.075032	10.116224	9.883776	30	42
19	45	9.808782	10.191218	9.925032	10.074968	10.116250	9.883750	15	41
20	5	9.808819	10.191181	9.925096	10.074904	10.116277	9.883723	55	40
21	15	9.808857	10.191143	9.925160	10.074840	10.116303	9.883697	45	39
22	30	9.808894	10.191106	9.925224	10.074776	10.116330	9.883670	30	38
23	45	9.808932	10.191068	9.925288	10.074712	10.116357	9.883643	15	37
24	6	9.808969	10.191031	9.925352	10.074648	10.116383	9.883617	54	36
25	15	9.809007	10.190993	9.925416	10.074584	10.116410	9.883590	45	35
26	30	9.809044	10.190956	9.925481	10.074519	10.116436	9.883564	30	34
27	45	9.809082	10.190918	9.925545	10.074455	10.116463	9.883537	15	33
28	7	9.809119	10.190881	9.925609	10.074391	10.116490	9.883510	53	32
29	15	9.809157	10.190843	9.925673	10.074327	10.116516	9.883484	45	31
30	30	9.809194	10.190806	9.925737	10.074263	10.116543	9.883457	30	30
31	45	9.809232	10.190768	9.925801	10.074199	10.116570	9.883430	15	29
32	8	9.809269	10.190731	9.925865	10.074135	10.116596	9.883404	52	28
33	15	9.809307	10.190693	9.925929	10.074071	10.116623	9.883377	45	27
34	30	9.809344	10.190656	9.925993	10.074007	10.116649	9.883351	30	26
35	45	9.809381	10.190619	9.926057	10.073943	10.116676	9.883324	15	25
36	9	9.809419	10.190581	9.926121	10.073879	10.116703	9.883297	51	24
37	15	9.809456	10.190544	9.926186	10.073814	10.116729	9.883271	45	23
38	30	9.809494	10.190506	9.926250	10.073750	10.116756	9.883244	30	22
39	45	9.809531	10.190469	9.926314	10.073686	10.116783	9.883217	15	21
40	10	9.809569	10.190431	9.926378	10.073622	10.116809	9.883191	50	20
41	15	9.809606	10.190394	9.926442	10.073558	10.116836	9.883164	45	19
42	30	9.809643	10.190357	9.926506	10.073494	10.116863	9.883137	30	18
43	45	9.809681	10.190319	9.926570	10.073430	10.116889	9.883111	15	17
44	11	9.809718	10.190282	9.926634	10.073366	10.116916	9.883084	49	16
45	15	9.809756	10.190244	9.926698	10.073302	10.116943	9.883057	45	15
46	30	9.809793	10.190207	9.926762	10.073238	10.116969	9.883031	30	14
47	45	9.809830	10.190170	9.926826	10.073174	10.116996	9.883004	15	13
48	12	9.809868	10.190132	9.926890	10.073110	10.117023	9.882977	48	12
49	15	9.809905	10.190095	9.926954	10.073046	10.117049	9.882951	45	11
50	30	9.809942	10.190058	9.927018	10.072982	10.117076	9.882924	30	10
51	45	9.809980	10.190020	9.927083	10.072917	10.117103	9.882897	15	9
52	13	9.810017	10.189983	9.927147	10.072853	10.117129	9.882871	47	8
53	15	9.810055	10.189945	9.927211	10.072789	10.117156	9.882844	45	7
54	30	9.810092	10.189908	9.927275	10.072725	10.117183	9.882817	30	6
55	45	9.810129	10.189871	9.927339	10.072661	10.117210	9.882790	15	5
56	14	9.810167	10.189833	9.927403	10.072597	10.117236	9.882764	46	4
57	15	9.810204	10.189796	9.927467	10.072533	10.117263	9.882737	45	3
58	30	9.810241	10.189759	9.927531	10.072469	10.117290	9.882710	30	2
59	45	9.810278	10.189722	9.927595	10.072405	10.117316	9.882684	15	1
60	15	9.810316	10.189684	9.927659	10.072341	10.117343	9.882657	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

2 ^h 41 ^m .		LOG. SINES, &c. (t.)						40 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.810316	10.189684	9.927659	10.072341	10.117343	9.882657	45	60
1	15	9.810353	10.189647	9.927723	10.072277	10.117370	9.882630	45	59
2	30	9.810390	10.189610	9.927787	10.072213	10.117397	9.882603	30	58
3	45	9.810428	10.189572	9.927851	10.072149	10.117423	9.882577	15	57
4	16	9.810465	10.189535	9.927915	10.072085	10.117450	9.882550	44	56
5	15	9.810502	10.189498	9.927979	10.072021	10.117477	9.882523	45	55
6	30	9.810540	10.189460	9.928043	10.071957	10.117504	9.882496	30	54
7	45	9.810577	10.189423	9.928107	10.071893	10.117530	9.882470	15	53
8	17	9.810614	10.189386	9.928171	10.071829	10.117557	9.882443	43	52
9	15	9.810651	10.189349	9.928235	10.071765	10.117584	9.882416	45	51
10	30	9.810689	10.189311	9.928299	10.071701	10.117611	9.882389	30	50
11	45	9.810726	10.189274	9.928363	10.071637	10.117638	9.882362	15	49
12	18	9.810763	10.189237	9.928427	10.071573	10.117664	9.882336	42	48
13	15	9.810800	10.189200	9.928491	10.071509	10.117691	9.882309	45	47
14	30	9.810838	10.189162	9.928555	10.071445	10.117718	9.882282	30	46
15	45	9.810875	10.189125	9.928619	10.071381	10.117745	9.882255	15	45
16	19	9.810912	10.189088	9.928683	10.071317	10.117772	9.882228	41	44
17	15	9.810949	10.189051	9.928747	10.071253	10.117798	9.882202	45	43
18	30	9.810986	10.189014	9.928812	10.071188	10.117825	9.882175	30	42
19	45	9.811024	10.188976	9.928876	10.071124	10.117852	9.882148	15	41
20	20	9.811061	10.188939	9.928940	10.071060	10.117879	9.882121	40	40
21	15	9.811098	10.188902	9.929004	10.070996	10.117906	9.882094	45	39
22	30	9.811135	10.188865	9.929068	10.070932	10.117932	9.882068	30	38
23	45	9.811172	10.188828	9.929132	10.070868	10.117959	9.882041	15	37
24	21	9.811210	10.188790	9.929196	10.070804	10.117986	9.882014	39	36
25	15	9.811247	10.188753	9.929260	10.070740	10.118013	9.881987	45	35
26	30	9.811284	10.188716	9.929324	10.070676	10.118040	9.881960	30	34
27	45	9.811321	10.188679	9.929388	10.070612	10.118067	9.881933	15	33
28	22	9.811358	10.188642	9.929452	10.070548	10.118093	9.881907	38	32
29	15	9.811395	10.188605	9.929516	10.070484	10.118120	9.881880	45	31
30	30	9.811433	10.188567	9.929580	10.070420	10.118147	9.881853	30	30
31	45	9.811470	10.188530	9.929644	10.070356	10.118174	9.881826	15	29
32	23	9.811507	10.188493	9.929708	10.070292	10.118201	9.881799	37	28
33	15	9.811544	10.188456	9.929772	10.070228	10.118228	9.881772	45	27
34	30	9.811581	10.188419	9.929836	10.070164	10.118255	9.881745	30	26
35	45	9.811618	10.188382	9.929900	10.070100	10.118281	9.881719	15	25
36	24	9.811655	10.188345	9.929964	10.070036	10.118308	9.881692	36	24
37	15	9.811692	10.188308	9.930028	10.069972	10.118335	9.881665	45	23
38	30	9.811730	10.188270	9.930092	10.069908	10.118362	9.881638	30	22
39	45	9.811767	10.188233	9.930156	10.069844	10.118389	9.881611	15	21
40	25	9.811804	10.188196	9.930219	10.069781	10.118416	9.881584	35	20
41	15	9.811841	10.188159	9.930283	10.069717	10.118443	9.881557	45	19
42	30	9.811878	10.188122	9.930347	10.069653	10.118470	9.881530	30	18
43	45	9.811915	10.188085	9.930411	10.069589	10.118497	9.881503	15	17
44	26	9.811952	10.188048	9.930475	10.069525	10.118523	9.881477	34	16
45	15	9.811989	10.188011	9.930539	10.069461	10.118550	9.881450	45	15
46	30	9.812026	10.187974	9.930603	10.069397	10.118577	9.881423	30	14
47	45	9.812063	10.187937	9.930667	10.069333	10.118604	9.881396	15	13
48	27	9.812100	10.187900	9.930731	10.069269	10.118631	9.881369	33	12
49	15	9.812137	10.187863	9.930795	10.069205	10.118658	9.881342	45	11
50	30	9.812174	10.187826	9.930859	10.069141	10.118685	9.881315	30	10
51	45	9.812211	10.187789	9.930923	10.069077	10.118712	9.881288	15	9
52	28	9.812248	10.187752	9.930987	10.069013	10.118739	9.881261	32	8
53	15	9.812285	10.187715	9.931051	10.068949	10.118766	9.881234	45	7
54	30	9.812322	10.187678	9.931115	10.068885	10.118793	9.881207	30	6
55	45	9.812359	10.187641	9.931179	10.068821	10.118820	9.881180	15	5
56	29	9.812396	10.187604	9.931243	10.068757	10.118847	9.881153	31	4
57	15	9.812433	10.187567	9.931307	10.068693	10.118874	9.881126	45	3
58	30	9.812470	10.187530	9.931371	10.068629	10.118901	9.881099	30	2
59	45	9.812507	10.187493	9.931435	10.068565	10.118928	9.881072	15	1
60	30	9.812544	10.187456	9.931499	10.068501	10.118955	9.881045	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 18 ^m .		LOG. SINES, &c.						49 deg.	

2 ^h 42 ^m .			LOG. SINES, &c. (t.)					40 deg.		
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.	
0	30	9.812544	10.187456	9.931499	10.068501	10.118955	9.881045	30	60	
1	15	9.812581	10.187419	9.931563	10.068437	10.118982	9.881018	45	59	
2	30	9.812618	10.187382	9.931627	10.068373	10.119008	9.880992	30	58	
3	45	9.812655	10.187345	9.931691	10.068309	10.119035	9.880965	15	57	
4	31	9.812692	10.187308	9.931755	10.068245	10.119062	9.880938	29	56	
5	15	9.812729	10.187271	9.931819	10.068181	10.119089	9.880911	45	55	
6	30	9.812766	10.187234	9.931883	10.068117	10.119116	9.880884	30	54	
7	45	9.812803	10.187197	9.931946	10.068054	10.119143	9.880857	15	53	
8	32	9.812840	10.187160	9.932010	10.067990	10.119170	9.880830	28	52	
9	15	9.812877	10.187123	9.932074	10.067926	10.119197	9.880803	45	51	
10	30	9.812914	10.187086	9.932138	10.067862	10.119224	9.880776	30	50	
11	45	9.812951	10.187049	9.932202	10.067798	10.119251	9.880749	15	49	
12	33	9.812988	10.187012	9.932266	10.067734	10.119279	9.880721	27	48	
13	15	9.813025	10.186975	9.932330	10.067670	10.119306	9.880694	45	47	
14	30	9.813062	10.186938	9.932394	10.067606	10.119333	9.880667	30	46	
15	45	9.813098	10.186902	9.932458	10.067542	10.119360	9.880640	15	45	
16	34	9.813135	10.186865	9.932522	10.067478	10.119387	9.880613	26	44	
17	15	9.813172	10.186828	9.932586	10.067414	10.119414	9.880586	45	43	
18	30	9.813209	10.186791	9.932650	10.067350	10.119441	9.880559	30	42	
19	45	9.813246	10.186754	9.932714	10.067286	10.119468	9.880532	15	41	
20	35	9.813283	10.186717	9.932778	10.067222	10.119495	9.880505	25	40	
21	15	9.813320	10.186680	9.932842	10.067158	10.119522	9.880478	45	39	
22	30	9.813357	10.186643	9.932905	10.067095	10.119549	9.880451	30	38	
23	45	9.813393	10.186607	9.932969	10.067031	10.119576	9.880424	15	37	
24	36	9.813430	10.186570	9.933033	10.066967	10.119603	9.880397	24	36	
25	15	9.813467	10.186533	9.933097	10.066903	10.119630	9.880370	45	35	
26	30	9.813504	10.186496	9.933161	10.066839	10.119657	9.880343	30	34	
27	45	9.813541	10.186459	9.933225	10.066775	10.119684	9.880316	15	33	
28	37	9.813578	10.186422	9.933289	10.066711	10.119711	9.880289	23	32	
29	15	9.813614	10.186386	9.933353	10.066647	10.119738	9.880262	45	31	
30	30	9.813651	10.186349	9.933417	10.066583	10.119766	9.880234	30	30	
31	45	9.813688	10.186312	9.933481	10.066519	10.119793	9.880207	15	29	
32	38	9.813725	10.186275	9.933545	10.066455	10.119820	9.880180	22	28	
33	15	9.813762	10.186238	9.933609	10.066391	10.119847	9.880153	45	27	
34	30	9.813799	10.186201	9.933672	10.066328	10.119874	9.880126	30	26	
35	45	9.813835	10.186165	9.933736	10.066264	10.119901	9.880099	15	25	
36	39	9.813872	10.186128	9.933800	10.066200	10.119928	9.880072	21	24	
37	15	9.813909	10.186091	9.933864	10.066136	10.119955	9.880045	45	23	
38	30	9.813946	10.186054	9.933928	10.066072	10.119982	9.880018	30	22	
39	45	9.813982	10.186018	9.933992	10.066008	10.120010	9.879990	15	21	
40	40	9.814019	10.185981	9.934056	10.065944	10.120037	9.879963	20	20	
41	15	9.814056	10.185944	9.934120	10.065880	10.120064	9.879936	45	19	
42	30	9.814093	10.185907	9.934184	10.065816	10.120091	9.879909	30	18	
43	45	9.814129	10.185871	9.934247	10.065753	10.120118	9.879882	15	17	
44	41	9.814166	10.185834	9.934311	10.065689	10.120145	9.879855	19	16	
45	15	9.814203	10.185797	9.934375	10.065625	10.120172	9.879828	45	15	
46	30	9.814240	10.185760	9.934439	10.065561	10.120200	9.879800	30	14	
47	45	9.814276	10.185724	9.934503	10.065497	10.120227	9.879773	15	13	
48	42	9.814313	10.185687	9.934567	10.065433	10.120254	9.879746	18	12	
49	15	9.814350	10.185650	9.934631	10.065369	10.120281	9.879719	45	11	
50	30	9.814387	10.185613	9.934695	10.065305	10.120308	9.879692	30	10	
51	45	9.814423	10.185577	9.934759	10.065241	10.120335	9.879665	15	9	
52	43	9.814460	10.185540	9.934822	10.065178	10.120363	9.879637	17	8	
53	15	9.814497	10.185503	9.934886	10.065114	10.120390	9.879610	45	7	
54	30	9.814533	10.185467	9.934950	10.065050	10.120417	9.879583	30	6	
55	45	9.814570	10.185430	9.935014	10.064986	10.120444	9.879556	15	5	
56	44	9.814607	10.185393	9.935078	10.064922	10.120471	9.879529	16	4	
57	15	9.814643	10.185357	9.935142	10.064858	10.120499	9.879501	45	3	
58	30	9.814680	10.185320	9.935206	10.064794	10.120526	9.879474	30	2	
59	45	9.814717	10.185283	9.935270	10.064730	10.120553	9.879447	15	1	
60	45	9.814753	10.185247	9.935333	10.064667	10.120580	9.879420	15	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.	
3 ^h 17 ^m .			LOG. SINES, &c.					49 deg.		

2 ^h 43 ^m .		LOG. SINES, &c. (t.)						40 deg	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.814753	10.185247	9.935333	10.064667	10.120580	9.879420	15	60
1	15	9.814790	10.185210	9.935397	10.064603	10.120607	9.879393	45	59
2	30	9.814827	10.185173	9.935461	10.064539	10.120635	9.879365	30	58
3	45	9.814863	10.185137	9.935525	10.064475	10.120662	9.879338	15	57
4	46	9.814900	10.185100	9.935589	10.064411	10.120689	9.879311	14	56
5	15	9.814937	10.185063	9.935653	10.064347	10.120716	9.879284	45	55
6	30	9.814973	10.185027	9.935717	10.064283	10.120744	9.879256	30	54
7	45	9.815010	10.184990	9.935780	10.064220	10.120771	9.879229	15	53
8	47	9.815046	10.184954	9.935844	10.064156	10.120798	9.879202	13	52
9	15	9.815083	10.184917	9.935908	10.064092	10.120825	9.879175	45	51
10	30	9.815120	10.184880	9.935972	10.064028	10.120852	9.879148	30	50
11	45	9.815156	10.184844	9.936036	10.063964	10.120880	9.879120	15	49
12	48	9.815193	10.184807	9.936100	10.063900	10.120907	9.879093	12	48
13	15	9.815229	10.184771	9.936164	10.063836	10.120934	9.879066	45	47
14	30	9.815266	10.184734	9.936227	10.063773	10.120962	9.879038	30	46
15	45	9.815303	10.184697	9.936291	10.063709	10.120989	9.879011	15	45
16	49	9.815339	10.184661	9.936355	10.063645	10.121016	9.878984	11	44
17	15	9.815376	10.184624	9.936419	10.063581	10.121043	9.878957	45	43
18	30	9.815412	10.184588	9.936483	10.063517	10.121071	9.878929	30	42
19	45	9.815449	10.184551	9.936547	10.063453	10.121098	9.878902	15	41
20	50	9.815485	10.184515	9.936610	10.063390	10.121125	9.878875	10	40
21	15	9.815522	10.184478	9.936674	10.063326	10.121153	9.878848	45	39
22	30	9.815558	10.184442	9.936738	10.063262	10.121180	9.878820	30	38
23	45	9.815595	10.184405	9.936802	10.063198	10.121207	9.878793	15	37
24	51	9.815631	10.184369	9.936866	10.063134	10.121234	9.878766	9	36
25	15	9.815668	10.184332	9.936930	10.063070	10.121262	9.878738	45	35
26	30	9.815704	10.184296	9.936994	10.063006	10.121289	9.878711	30	34
27	45	9.815741	10.184259	9.937057	10.062943	10.121316	9.878684	15	33
28	52	9.815778	10.184222	9.937121	10.062879	10.121344	9.878656	8	32
29	15	9.815814	10.184186	9.937185	10.062815	10.121371	9.878629	45	31
30	30	9.815851	10.184149	9.937249	10.062751	10.121398	9.878602	30	30
31	45	9.815887	10.184113	9.937313	10.062687	10.121426	9.878574	15	29
32	53	9.815923	10.184077	9.937376	10.062624	10.121453	9.878547	7	28
33	15	9.815960	10.184040	9.937440	10.062560	10.121480	9.878520	45	27
34	30	9.815996	10.184004	9.937504	10.062496	10.121508	9.878492	30	26
35	45	9.816033	10.183967	9.937568	10.062432	10.121535	9.878465	15	25
36	54	9.816069	10.183931	9.937632	10.062368	10.121562	9.878438	6	24
37	15	9.816106	10.183894	9.937696	10.062304	10.121590	9.878410	45	23
38	30	9.816142	10.183858	9.937759	10.062241	10.121617	9.878383	30	22
39	45	9.816179	10.183821	9.937823	10.062177	10.121645	9.878355	15	21
40	55	9.816215	10.183785	9.937887	10.062113	10.121672	9.878328	5	20
41	15	9.816252	10.183748	9.937951	10.062049	10.121699	9.878301	45	19
42	30	9.816288	10.183712	9.938015	10.061985	10.121727	9.878273	30	18
43	45	9.816324	10.183676	9.938078	10.061922	10.121754	9.878246	15	17
44	56	9.816361	10.183639	9.938142	10.061858	10.121781	9.878219	4	16
45	15	9.816397	10.183603	9.938206	10.061794	10.121809	9.878191	45	15
46	30	9.816434	10.183566	9.938270	10.061730	10.121836	9.878164	30	14
47	45	9.816470	10.183530	9.938334	10.061666	10.121864	9.878136	15	13
48	57	9.816507	10.183493	9.938397	10.061603	10.121891	9.878109	3	12
49	15	9.816543	10.183457	9.938461	10.061539	10.121918	9.878082	45	11
50	30	9.816579	10.183421	9.938525	10.061475	10.121946	9.878054	30	10
51	45	9.816616	10.183384	9.938589	10.061411	10.121973	9.878027	15	9
52	58	9.816652	10.183348	9.938653	10.061347	10.122001	9.877999	2	8
53	15	9.816688	10.183312	9.938716	10.061284	10.122028	9.877972	45	7
54	30	9.816725	10.183275	9.938780	10.061220	10.122056	9.877944	30	6
55	45	9.816761	10.183239	9.938844	10.061156	10.122083	9.877917	15	5
56	59	9.816797	10.183203	9.938908	10.061092	10.122110	9.877890	1	4
57	15	9.816834	10.183166	9.938972	10.061028	10.122138	9.877862	45	3
58	30	9.816870	10.183130	9.939035	10.060965	10.122165	9.877835	30	2
59	45	9.816907	10.183093	9.939099	10.060901	10.122193	9.877807	15	1
60	60	9.816943	10.183057	9.939163	10.060837	10.122220	9.877780	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 16 ^m .		LOG. SINES, &c.						49 deg.	

2 ^h 44 ^m .				LOG. SINES, &c. (t.)				41 deg.			
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	"	sec.	
0	0	9.816943	10.183057	9.939163	10.060837	10.122220	9.877780	60		60	
1	15	9.816979	10.183021	9.939227	10.060773	10.122248	9.877752	45		59	
2	30	9.817016	10.182984	9.939291	10.060709	10.122275	9.877725	30		58	
3	45	9.817052	10.182948	9.939354	10.060646	10.122303	9.877697	15		57	
4	1	9.817088	10.182912	9.939418	10.060582	10.122330	9.877670		59	56	
5	15	9.817124	10.182876	9.939482	10.060518	10.122358	9.877642	45		55	
6	30	9.817161	10.182839	9.939546	10.060454	10.122385	9.877615	30		54	
7	45	9.817197	10.182803	9.939609	10.060391	10.122412	9.877588	15		53	
8	2	9.817233	10.182767	9.939673	10.060327	10.122440	9.877560		58	52	
9	15	9.817270	10.182730	9.939737	10.060263	10.122467	9.877533	45		51	
10	30	9.817306	10.182694	9.939801	10.060199	10.122495	9.877505	30		50	
11	45	9.817342	10.182658	9.939865	10.060135	10.122522	9.877478	15		49	
12	3	9.817378	10.182622	9.939928	10.060072	10.122550	9.877450		57	48	
13	15	9.817415	10.182585	9.939992	10.060008	10.122577	9.877423	45		47	
14	30	9.817451	10.182549	9.940056	10.059944	10.122605	9.877395	30		46	
15	45	9.817487	10.182513	9.940120	10.059880	10.122632	9.877368	15		45	
16	4	9.817523	10.182477	9.940183	10.059817	10.122660	9.877340		56	44	
17	15	9.817560	10.182440	9.940247	10.059753	10.122687	9.877313	45		43	
18	30	9.817596	10.182404	9.940311	10.059689	10.122715	9.877285	30		42	
19	45	9.817632	10.182368	9.940375	10.059625	10.122743	9.877257	15		41	
20	5	9.817668	10.182332	9.940438	10.059562	10.122770	9.877230		55	40	
21	15	9.817705	10.182295	9.940502	10.059498	10.122798	9.877202	45		39	
22	30	9.817741	10.182259	9.940566	10.059434	10.122825	9.877175	30		38	
23	45	9.817777	10.182223	9.940630	10.059370	10.122853	9.877147	15		37	
24	6	9.817813	10.182187	9.940694	10.059306	10.122880	9.877120		54	36	
25	15	9.817849	10.182151	9.940757	10.059243	10.122908	9.877092	45		35	
26	30	9.817886	10.182114	9.940821	10.059179	10.122935	9.877065	30		34	
27	45	9.817922	10.182078	9.940885	10.059115	10.122963	9.877037	15		33	
28	7	9.817958	10.182042	9.940949	10.059051	10.122990	9.877010		53	32	
29	15	9.817994	10.182006	9.941012	10.058988	10.123018	9.876982	45		31	
30	30	9.818030	10.181970	9.941076	10.058924	10.123046	9.876954	30		30	
31	45	9.818066	10.181933	9.941140	10.058860	10.123073	9.876927	15		29	
32	8	9.818103	10.181897	9.941204	10.058796	10.123101	9.876899		52	28	
33	15	9.818139	10.181861	9.941267	10.058733	10.123128	9.876872	45		27	
34	30	9.818175	10.181825	9.941331	10.058669	10.123156	9.876844	30		26	
35	45	9.818211	10.181789	9.941395	10.058605	10.123184	9.876816	15		25	
36	9	9.818247	10.181753	9.941458	10.058542	10.123211	9.876789		51	24	
37	15	9.818283	10.181717	9.941522	10.058478	10.123239	9.876761	45		23	
38	30	9.818320	10.181680	9.941586	10.058414	10.123266	9.876734	30		22	
39	45	9.818356	10.181644	9.941650	10.058350	10.123294	9.876706	15		21	
40	10	9.818392	10.181608	9.941713	10.058287	10.123322	9.876678		50	20	
41	15	9.818428	10.181572	9.941777	10.058223	10.123349	9.876651	45		19	
42	30	9.818464	10.181536	9.941841	10.058159	10.123377	9.876623	30		18	
43	45	9.818500	10.181500	9.941905	10.058095	10.123404	9.876596	15		17	
44	11	9.818536	10.181464	9.941968	10.058032	10.123432	9.876568		49	16	
45	15	9.818572	10.181428	9.942032	10.057968	10.123460	9.876540	45		15	
46	30	9.818609	10.181391	9.942096	10.057904	10.123487	9.876513	30		14	
47	45	9.818645	10.181355	9.942160	10.057840	10.123515	9.876485	15		13	
48	12	9.818681	10.181319	9.942223	10.057777	10.123543	9.876457		48	12	
49	15	9.818717	10.181283	9.942287	10.057713	10.123570	9.876430	45		11	
50	30	9.818753	10.181247	9.942351	10.057649	10.123598	9.876402	30		10	
51	45	9.818789	10.181211	9.942414	10.057586	10.123626	9.876374	15		9	
52	13	9.818825	10.181175	9.942478	10.057522	10.123653	9.876347		47	8	
53	15	9.818861	10.181139	9.942542	10.057458	10.123681	9.876319	45		7	
54	30	9.818897	10.181103	9.942606	10.057394	10.123709	9.876291	30		6	
55	45	9.818933	10.181067	9.942669	10.057331	10.123736	9.876264	15		5	
56	14	9.818969	10.181031	9.942733	10.057267	10.123764	9.876236		46	4	
57	15	9.819005	10.180995	9.942797	10.057203	10.123792	9.876208	45		3	
58	30	9.819041	10.180959	9.942860	10.057140	10.123819	9.876181	30		2	
59	45	9.819077	10.180923	9.942924	10.057076	10.123847	9.876153	15		1	
60	15	9.819113	10.180887	9.942988	10.057012	10.123875	9.876125		45	0	
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	"	sec.	
3 ^h 15 ^m .				LOG. SINES, &c.				48 deg.			

2 ^h 45 ^m .		LOG. SINES, &c. (t.)						41 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.819113	10.180887	9.942988	10.057012	10.123875	9.876125	45	60
1	15	9.819149	10.180851	9.943052	10.056948	10.123902	9.876098	45	59
2	30	9.819185	10.180815	9.943115	10.056885	10.123930	9.876070	30	58
3	45	9.819221	10.180779	9.943179	10.056821	10.123958	9.876042	15	57
4	16	9.819257	10.180743	9.943243	10.056757	10.123986	9.876014	44	56
5	15	9.819293	10.180707	9.943306	10.056694	10.124013	9.875987	45	55
6	30	9.819329	10.180671	9.943370	10.056630	10.124041	9.875959	30	54
7	45	9.819365	10.180635	9.943434	10.056566	10.124069	9.875931	15	53
8	17	9.819401	10.180599	9.943498	10.056502	10.124096	9.875904	43	52
9	15	9.819437	10.180563	9.943561	10.056439	10.124124	9.875876	45	51
10	30	9.819473	10.180527	9.943625	10.056375	10.124152	9.875848	30	50
11	45	9.819509	10.180491	9.943689	10.056311	10.124180	9.875820	15	49
12	18	9.819545	10.180455	9.943752	10.056248	10.124207	9.875793	42	48
13	15	9.819581	10.180419	9.943816	10.056184	10.124235	9.875765	45	47
14	30	9.819617	10.180383	9.943880	10.056120	10.124263	9.875737	30	46
15	45	9.819653	10.180347	9.943943	10.056057	10.124291	9.875709	15	45
16	19	9.819689	10.180311	9.944007	10.055993	10.124318	9.875682	41	44
17	15	9.819725	10.180275	9.944071	10.055929	10.124346	9.875654	45	43
18	30	9.819761	10.180239	9.944134	10.055866	10.124374	9.875626	30	42
19	45	9.819797	10.180203	9.944198	10.055802	10.124402	9.875598	15	41
20	20	9.819832	10.180167	9.944262	10.055738	10.124429	9.875571	40	40
21	15	9.819868	10.180132	9.944326	10.055674	10.124457	9.875543	45	39
22	30	9.819904	10.180096	9.944389	10.055611	10.124485	9.875515	30	38
23	45	9.819940	10.180060	9.944453	10.055547	10.124513	9.875487	15	37
24	21	9.819976	10.180024	9.944517	10.055483	10.124541	9.875459	39	36
25	15	9.820012	10.179988	9.944580	10.055420	10.124568	9.875432	45	35
26	30	9.820048	10.179952	9.944644	10.055356	10.124596	9.875404	30	34
27	45	9.820084	10.179916	9.944708	10.055292	10.124624	9.875376	15	33
28	22	9.820120	10.179880	9.944771	10.055229	10.124652	9.875348	38	32
29	15	9.820155	10.179845	9.944835	10.055165	10.124680	9.875320	45	31
30	30	9.820191	10.179809	9.944899	10.055101	10.124707	9.875293	30	30
31	45	9.820227	10.179773	9.944962	10.055038	10.124735	9.875265	15	29
32	23	9.820263	10.179737	9.945026	10.054974	10.124763	9.875237	37	28
33	15	9.820299	10.179701	9.945090	10.054910	10.124791	9.875209	45	27
34	30	9.820335	10.179665	9.945153	10.054847	10.124819	9.875181	30	26
35	45	9.820370	10.179630	9.945217	10.054783	10.124847	9.875153	15	25
36	24	9.820406	10.179594	9.945281	10.054719	10.124874	9.875126	36	24
37	15	9.820442	10.179558	9.945344	10.054656	10.124902	9.875098	45	23
38	30	9.820478	10.179522	9.945408	10.054592	10.124930	9.875070	30	22
39	45	9.820514	10.179486	9.945472	10.054528	10.124958	9.875042	15	21
40	25	9.820550	10.179450	9.945535	10.054465	10.124986	9.875014	35	20
41	15	9.820585	10.179415	9.945599	10.054401	10.125014	9.874986	45	19
42	30	9.820621	10.179379	9.945663	10.054337	10.125042	9.874958	30	18
43	45	9.820657	10.179343	9.945726	10.054274	10.125069	9.874931	15	17
44	26	9.820693	10.179307	9.945790	10.054210	10.125097	9.874903	34	16
45	15	9.820728	10.179272	9.945854	10.054146	10.125125	9.874875	45	15
46	30	9.820764	10.179236	9.945917	10.054083	10.125153	9.874847	30	14
47	45	9.820800	10.179200	9.945981	10.054019	10.125181	9.874819	15	13
48	27	9.820836	10.179164	9.946045	10.053955	10.125209	9.874791	33	12
49	15	9.820872	10.179128	9.946108	10.053892	10.125237	9.874763	45	11
50	30	9.820907	10.179093	9.946172	10.053828	10.125265	9.874735	30	10
51	45	9.820943	10.179057	9.946236	10.053764	10.125293	9.874707	15	9
52	28	9.820979	10.179021	9.946299	10.053701	10.125321	9.874679	32	8
53	15	9.821015	10.178985	9.946363	10.053637	10.125348	9.874652	45	7
54	30	9.821050	10.178950	9.946427	10.053573	10.125376	9.874624	30	6
55	45	9.821086	10.178914	9.946490	10.053510	10.125404	9.874596	15	5
56	29	9.821122	10.178878	9.946554	10.053446	10.125432	9.874568	31	4
57	15	9.821157	10.178843	9.946617	10.053383	10.125460	9.874540	45	3
58	30	9.821193	10.178807	9.946681	10.053319	10.125488	9.874512	30	2
59	45	9.821229	10.178771	9.946745	10.053255	10.125516	9.874484	15	1
60	30	9.821265	10.178735	9.946808	10.053192	10.125544	9.874456	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 14 ^m .		LOG. SINES, &c.						48 deg.	

2 ^h 46 ^m .			LOG. SINES, &c. (t.)					41 deg.		
sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	sec.
0	30		9.821265	10.178735	9.946808	10.053192	10.125544	9.874456	30	60
1		15	9.821300	10.178700	9.946872	10.053128	10.125572	9.874428	45	59
2		30	9.821336	10.178664	9.946936	10.053064	10.125600	9.874400	30	58
3		45	9.821372	10.178628	9.946999	10.053001	10.125628	9.874372	15	57
4	31		9.821407	10.178593	9.947063	10.052937	10.125656	9.874344	29	56
5		15	9.821443	10.178557	9.947127	10.052873	10.125684	9.874316	45	55
6		30	9.821479	10.178521	9.947190	10.052810	10.125712	9.874288	30	54
7		45	9.821514	10.178486	9.947254	10.052746	10.125740	9.874260	15	53
8	32		9.821550	10.178450	9.947317	10.052683	10.125768	9.874232	28	52
9		15	9.821586	10.178414	9.947381	10.052619	10.125796	9.874204	45	51
10		30	9.821621	10.178379	9.947445	10.052555	10.125824	9.874176	30	50
11		45	9.821657	10.178343	9.947508	10.052492	10.125852	9.874148	15	49
12	33		9.821693	10.178307	9.947572	10.052428	10.125880	9.874120	27	48
13		15	9.821728	10.178272	9.947636	10.052364	10.125908	9.874092	45	47
14		30	9.821764	10.178236	9.947699	10.052301	10.125935	9.874064	30	46
15		45	9.821799	10.178201	9.947763	10.052237	10.125963	9.874037	15	45
16	34		9.821835	10.178165	9.947826	10.052174	10.125992	9.874008	26	44
17		15	9.821871	10.178129	9.947890	10.052110	10.126020	9.873980	45	43
18		30	9.821906	10.178094	9.947954	10.052046	10.126048	9.873952	30	42
19		45	9.821942	10.178058	9.948017	10.051983	10.126076	9.873924	15	41
20	35		9.821977	10.178023	9.948081	10.051919	10.126104	9.873896	25	40
21		15	9.822013	10.177987	9.948145	10.051855	10.126132	9.873868	45	39
22		30	9.822049	10.177951	9.948208	10.051792	10.126160	9.873840	30	38
23		45	9.822084	10.177916	9.948272	10.051728	10.126188	9.873812	15	37
24	36		9.822120	10.177880	9.948335	10.051665	10.126216	9.873784	24	36
25		15	9.822155	10.177845	9.948399	10.051601	10.126244	9.873756	45	35
26		30	9.822191	10.177809	9.948463	10.051537	10.126272	9.873728	30	34
27		45	9.822226	10.177774	9.948526	10.051474	10.126300	9.873700	15	33
28	37		9.822262	10.177738	9.948590	10.051410	10.126328	9.873672	23	32
29		15	9.822298	10.177702	9.948653	10.051347	10.126356	9.873644	45	31
30		30	9.822333	10.177667	9.948717	10.051283	10.126384	9.873616	30	30
31		45	9.822369	10.177631	9.948781	10.051219	10.126412	9.873588	15	29
32	38		9.822404	10.177596	9.948844	10.051156	10.126440	9.873560	22	28
33		15	9.822440	10.177560	9.948908	10.051092	10.126468	9.873532	45	27
34		30	9.822475	10.177525	9.948971	10.051029	10.126496	9.873504	30	26
35		45	9.822511	10.177489	9.949035	10.050965	10.126524	9.873476	15	25
36	39		9.822546	10.177454	9.949099	10.050901	10.126552	9.873448	21	24
37		15	9.822582	10.177418	9.949162	10.050838	10.126581	9.873419	45	23
38		30	9.822617	10.177383	9.949226	10.050774	10.126609	9.873391	30	22
39		45	9.822653	10.177347	9.949289	10.050711	10.126637	9.873363	15	21
40	40		9.822688	10.177312	9.949353	10.050647	10.126665	9.873335	20	20
41		15	9.822724	10.177276	9.949417	10.050583	10.126693	9.873307	45	19
42		30	9.822759	10.177241	9.949480	10.050520	10.126721	9.873279	30	18
43		45	9.822795	10.177205	9.949544	10.050456	10.126749	9.873251	15	17
44	41		9.822830	10.177170	9.949607	10.050393	10.126777	9.873223	19	16
45		15	9.822866	10.177134	9.949671	10.050329	10.126805	9.873195	45	15
46		30	9.822901	10.177099	9.949735	10.050265	10.126834	9.873167	30	14
47		45	9.822937	10.177063	9.949798	10.050202	10.126862	9.873138	15	13
48	42		9.822972	10.177028	9.949862	10.050138	10.126890	9.873110	18	12
49		15	9.823007	10.176993	9.949925	10.050075	10.126918	9.873082	45	11
50		30	9.823043	10.176957	9.949989	10.050011	10.126946	9.873054	30	10
51		45	9.823078	10.176922	9.950053	10.049947	10.126974	9.873026	15	9
52	43		9.823114	10.176886	9.950116	10.049884	10.127002	9.872998	17	8
53		15	9.823149	10.176851	9.950180	10.049820	10.127031	9.872969	45	7
54		30	9.823185	10.176815	9.950243	10.049757	10.127059	9.872941	30	6
55		45	9.823220	10.176780	9.950307	10.049693	10.127087	9.872913	15	5
56	44		9.823255	10.176745	9.950370	10.049630	10.127115	9.872885	16	4
57		15	9.823291	10.176709	9.950434	10.049566	10.127143	9.872857	45	3
58		30	9.823326	10.176674	9.950498	10.049502	10.127171	9.872829	30	2
59		45	9.823362	10.176638	9.950561	10.049439	10.127200	9.872800	15	1
60	45		9.823397	10.176603	9.950625	10.049375	10.127228	9.872772	15	0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	sec.
3 ^h 13 ^m .			LOG. SINES, &c.					48 deg.		

2 ^h 47 ^m .		LOG. SINES, &c. (t.)						41 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.823397	10.176603	9.950625	10.049375	10.127228	9.872772	15	60
1	15	9.823432	10.176568	9.950688	10.049312	10.127256	9.872744	45	59
2	30	9.823468	10.176532	9.950752	10.049248	10.127284	9.872716	30	58
3	45	9.823503	10.176497	9.950815	10.049185	10.127312	9.872688	15	57
4	46	9.823539	10.176461	9.950879	10.049121	10.127341	9.872659	14	56
5	15	9.823574	10.176426	9.950943	10.049057	10.127369	9.872631	45	55
6	30	9.823609	10.176391	9.951006	10.048994	10.127397	9.872603	30	54
7	45	9.823645	10.176355	9.951070	10.048930	10.127425	9.872575	15	53
8	47	9.823680	10.176320	9.951133	10.048867	10.127453	9.872547	13	52
9	15	9.823715	10.176285	9.951197	10.048803	10.127482	9.872518	45	51
10	30	9.823751	10.176249	9.951260	10.048740	10.127510	9.872490	30	50
11	45	9.823786	10.176214	9.951324	10.048676	10.127538	9.872462	15	49
12	48	9.823821	10.176179	9.951388	10.048612	10.127566	9.872434	12	48
13	15	9.823857	10.176143	9.951451	10.048549	10.127595	9.872405	45	47
14	30	9.823892	10.176108	9.951515	10.048485	10.127623	9.872377	30	46
15	45	9.823927	10.176073	9.951578	10.048422	10.127651	9.872349	15	45
16	49	9.823963	10.176037	9.951642	10.048358	10.127679	9.872321	11	44
17	15	9.823998	10.176002	9.951705	10.048295	10.127708	9.872292	45	43
18	30	9.824033	10.175967	9.951769	10.048231	10.127736	9.872264	30	42
19	45	9.824068	10.175932	9.951833	10.048167	10.127764	9.872236	15	41
20	50	9.824104	10.175896	9.951896	10.048104	10.127792	9.872208	10	40
21	15	9.824139	10.175861	9.951960	10.048040	10.127821	9.872179	45	39
22	30	9.824174	10.175826	9.952023	10.047977	10.127849	9.872151	30	38
23	45	9.824210	10.175790	9.952087	10.047913	10.127877	9.872123	15	37
24	51	9.824245	10.175755	9.952150	10.047850	10.127906	9.872094	9	36
25	15	9.824280	10.175720	9.952214	10.047786	10.127934	9.872066	45	35
26	30	9.824315	10.175685	9.952277	10.047723	10.127962	9.872038	30	34
27	45	9.824351	10.175649	9.952341	10.047659	10.127990	9.872010	15	33
28	52	9.824386	10.175614	9.952404	10.047596	10.128019	9.871981	8	32
29	15	9.824421	10.175579	9.952468	10.047532	10.128047	9.871953	45	31
30	30	9.824456	10.175544	9.952532	10.047468	10.128075	9.871925	30	30
31	45	9.824491	10.175509	9.952595	10.047405	10.128104	9.871896	15	29
32	53	9.824527	10.175473	9.952659	10.047341	10.128132	9.871868	7	28
33	15	9.824562	10.175438	9.952722	10.047278	10.128160	9.871840	45	27
34	30	9.824597	10.175403	9.952786	10.047214	10.128189	9.871811	30	26
35	45	9.824632	10.175368	9.952849	10.047151	10.128217	9.871783	15	25
36	54	9.824668	10.175332	9.952913	10.047087	10.128245	9.871755	6	24
37	15	9.824703	10.175297	9.952976	10.047024	10.128274	9.871726	45	23
38	30	9.824738	10.175262	9.953040	10.046960	10.128302	9.871698	30	22
39	45	9.824773	10.175227	9.953103	10.046897	10.128330	9.871670	15	21
40	55	9.824808	10.175192	9.953167	10.046833	10.128359	9.871641	5	20
41	15	9.824843	10.175157	9.953230	10.046770	10.128387	9.871613	45	19
42	30	9.824879	10.175121	9.953294	10.046706	10.128415	9.871585	30	18
43	45	9.824914	10.175086	9.953358	10.046642	10.128444	9.871556	15	17
44	56	9.824949	10.175051	9.953421	10.046579	10.128472	9.871528	4	16
45	15	9.824984	10.175016	9.953485	10.046515	10.128501	9.871499	45	15
46	30	9.825019	10.174981	9.953548	10.046452	10.128529	9.871471	30	14
47	45	9.825054	10.174946	9.953612	10.046388	10.128557	9.871443	15	13
48	57	9.825090	10.174910	9.953675	10.046325	10.128586	9.871414	3	12
49	15	9.825125	10.174875	9.953739	10.046261	10.128614	9.871386	45	11
50	30	9.825160	10.174840	9.953802	10.046198	10.128642	9.871358	30	10
51	45	9.825195	10.174805	9.953866	10.046134	10.128671	9.871329	15	9
52	58	9.825230	10.174770	9.953929	10.046071	10.128699	9.871301	2	8
53	15	9.825265	10.174735	9.953993	10.046007	10.128728	9.871272	45	7
54	30	9.825300	10.174700	9.954056	10.045944	10.128756	9.871244	30	6
55	45	9.825335	10.174665	9.954120	10.045880	10.128784	9.871216	15	5
56	59	9.825370	10.174630	9.954183	10.045817	10.128813	9.871187	1	4
57	15	9.825406	10.174594	9.954247	10.045753	10.128841	9.871159	45	3
58	30	9.825441	10.174559	9.954310	10.045690	10.128870	9.871130	30	2
59	45	9.825476	10.174524	9.954374	10.045626	10.128898	9.871102	15	1
60	60	9.825511	10.174489	9.954437	10.045563	10.128927	9.871073	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 12 ^m .		LOG. SINES, &c.						48 deg.	

2 ^h 48 ^m .		LOG. SINES, &c. (t.)						42 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.825511	10.174489	9.954437	10.045563	10.128927	9.871073	60	60
1	15	9.825546	10.174454	9.954501	10.045499	10.128955	9.871045	45	59
2	30	9.825581	10.174419	9.954564	10.045436	10.128983	9.871017	30	58
3	45	9.825616	10.174384	9.954628	10.045372	10.129012	9.870988	15	57
4	1	9.825651	10.174349	9.954691	10.045309	10.129040	9.870960	59	56
5	15	9.825686	10.174314	9.954755	10.045245	10.129069	9.870931	45	55
6	30	9.825721	10.174279	9.954818	10.045182	10.129097	9.870903	30	54
7	45	9.825756	10.174244	9.954882	10.045118	10.129126	9.870874	15	53
8	2	9.825791	10.174209	9.954945	10.045055	10.129154	9.870846	58	52
9	15	9.825826	10.174174	9.955009	10.044991	10.129183	9.870817	45	51
10	30	9.825861	10.174139	9.955072	10.044928	10.129211	9.870789	30	50
11	45	9.825896	10.174104	9.955136	10.044864	10.129240	9.870760	15	49
12	3	9.825931	10.174069	9.955199	10.044801	10.129268	9.870732	57	48
13	15	9.825966	10.174034	9.955263	10.044737	10.129297	9.870703	45	47
14	30	9.826001	10.173999	9.955326	10.044674	10.129325	9.870675	30	46
15	45	9.826036	10.173964	9.955390	10.044610	10.129354	9.870646	15	45
16	4	9.826071	10.173929	9.955453	10.044547	10.129382	9.870618	56	44
17	15	9.826106	10.173894	9.955517	10.044483	10.129411	9.870589	45	43
18	30	9.826141	10.173859	9.955580	10.044420	10.129439	9.870561	30	42
19	45	9.826176	10.173824	9.955644	10.044356	10.129468	9.870532	15	41
20	5	9.826211	10.173789	9.955707	10.044293	10.129496	9.870504	55	40
21	15	9.826246	10.173754	9.955771	10.044229	10.129525	9.870475	45	39
22	30	9.826281	10.173719	9.955834	10.044166	10.129553	9.870447	30	38
23	45	9.826316	10.173684	9.955898	10.044102	10.129582	9.870418	15	37
24	6	9.826351	10.173649	9.955961	10.044039	10.129610	9.870390	54	36
25	15	9.826386	10.173614	9.956025	10.043975	10.129639	9.870361	45	35
26	30	9.826421	10.173579	9.956088	10.043912	10.129667	9.870333	30	34
27	45	9.826456	10.173544	9.956152	10.043848	10.129696	9.870304	15	33
28	7	9.826491	10.173509	9.956215	10.043785	10.129724	9.870276	53	32
29	15	9.826526	10.173474	9.956279	10.043721	10.129753	9.870247	45	31
30	30	9.826561	10.173439	9.956342	10.043658	10.129782	9.870218	30	30
31	45	9.826596	10.173404	9.956406	10.043594	10.129810	9.870190	15	29
32	8	9.826631	10.173369	9.956469	10.043531	10.129839	9.870161	52	28
33	15	9.826666	10.173334	9.956533	10.043467	10.129867	9.870133	45	27
34	30	9.826700	10.173300	9.956596	10.043404	10.129896	9.870104	30	26
35	45	9.826735	10.173265	9.956660	10.043340	10.129924	9.870076	15	25
36	9	9.826770	10.173230	9.956723	10.043277	10.129953	9.870047	51	24
37	15	9.826805	10.173195	9.956787	10.043213	10.129982	9.870018	45	23
38	30	9.826840	10.173160	9.956850	10.043150	10.130010	9.869990	30	22
39	45	9.826875	10.173125	9.956914	10.043086	10.130039	9.869961	15	21
40	10	9.826910	10.173090	9.956977	10.043023	10.130067	9.869933	50	20
41	15	9.826945	10.173055	9.957041	10.042959	10.130096	9.869904	45	19
42	30	9.826980	10.173020	9.957104	10.042896	10.130125	9.869875	30	18
43	45	9.827014	10.172986	9.957168	10.042832	10.130153	9.869847	15	17
44	11	9.827049	10.172951	9.957231	10.042769	10.130182	9.869818	49	16
45	15	9.827084	10.172916	9.957295	10.042705	10.130210	9.869790	45	15
46	30	9.827119	10.172881	9.957358	10.042642	10.130239	9.869761	30	14
47	45	9.827154	10.172846	9.957421	10.042579	10.130268	9.869732	15	13
48	12	9.827189	10.172811	9.957485	10.042515	10.130296	9.869704	48	12
49	15	9.827223	10.172777	9.957548	10.042452	10.130325	9.869675	45	11
50	30	9.827258	10.172742	9.957612	10.042388	10.130354	9.869646	30	10
51	45	9.827293	10.172707	9.957675	10.042325	10.130382	9.869618	15	9
52	13	9.827328	10.172672	9.957739	10.042261	10.130411	9.869589	47	8
53	15	9.827363	10.172637	9.957802	10.042198	10.130440	9.869560	45	7
54	30	9.827398	10.172602	9.957866	10.042134	10.130468	9.869532	30	6
55	45	9.827432	10.172568	9.957929	10.042071	10.130497	9.869503	15	5
56	14	9.827467	10.172533	9.957993	10.042007	10.130526	9.869474	46	4
57	15	9.827502	10.172498	9.958056	10.041944	10.130554	9.869446	45	3
58	30	9.827537	10.172463	9.958120	10.041880	10.130583	9.869417	30	2
59	45	9.827571	10.172429	9.958183	10.041817	10.130612	9.869388	15	1
60	15	9.827606	10.172394	9.958246	10.041754	10.130640	9.869360	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 11 ^m .		LOG. SINES, &c.						47 deg.	

2 ^h 49 ^m .		LOG. SINES, &c. (t.)						42 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.827606	10.172394	9.958246	10.041754	10.130640	9.869360	45	60
1	15	9.827641	10.172359	9.958310	10.041690	10.130669	9.869331	45	59
2	30	9.827676	10.172324	9.958373	10.041627	10.130698	9.869302	30	58
3	45	9.827711	10.172289	9.958437	10.041563	10.130726	9.869274	15	57
4	16	9.827745	10.172255	9.958500	10.041500	10.130755	9.869245	44	56
5	15	9.827780	10.172220	9.958564	10.041436	10.130784	9.869216	45	55
6	30	9.827815	10.172185	9.958627	10.041373	10.130813	9.869187	30	54
7	45	9.827849	10.172151	9.958691	10.041309	10.130841	9.869159	15	53
8	17	9.827884	10.172116	9.958754	10.041246	10.130870	9.869130	43	52
9	15	9.827919	10.172081	9.958818	10.041182	10.130899	9.869101	45	51
10	30	9.827954	10.172046	9.958881	10.041119	10.130927	9.869073	30	50
11	45	9.827988	10.172012	9.958944	10.041056	10.130956	9.869044	15	49
12	18	9.828023	10.171977	9.959008	10.040992	10.130985	9.869015	42	48
13	15	9.828058	10.171942	9.959071	10.040929	10.131014	9.868986	45	47
14	30	9.828092	10.171908	9.959135	10.040865	10.131042	9.868958	30	46
15	45	9.828127	10.171873	9.959198	10.040802	10.131071	9.868929	15	45
16	19	9.828162	10.171838	9.959262	10.040738	10.131100	9.868900	41	44
17	15	9.828197	10.171803	9.959325	10.040675	10.131129	9.868871	45	43
18	30	9.828231	10.171769	9.959389	10.040611	10.131157	9.868843	30	42
19	45	9.828266	10.171734	9.959452	10.040548	10.131186	9.868814	15	41
20	20	9.828301	10.171699	9.959515	10.040485	10.131215	9.868785	40	40
21	15	9.828335	10.171665	9.959579	10.040421	10.131244	9.868756	45	39
22	30	9.828370	10.171630	9.959642	10.040358	10.131272	9.868728	30	38
23	45	9.828405	10.171595	9.959706	10.040294	10.131301	9.868699	15	37
24	21	9.828439	10.171561	9.959769	10.040231	10.131330	9.868670	39	36
25	15	9.828474	10.171526	9.959833	10.040167	10.131359	9.868641	45	35
26	30	9.828509	10.171491	9.959896	10.040104	10.131388	9.868612	30	34
27	45	9.828543	10.171457	9.959960	10.040040	10.131416	9.868584	15	33
28	22	9.828578	10.171422	9.960023	10.039977	10.131445	9.868555	38	32
29	15	9.828612	10.171388	9.960086	10.039914	10.131474	9.868526	45	31
30	30	9.828647	10.171353	9.960150	10.039850	10.131503	9.868497	30	30
31	45	9.828682	10.171318	9.960213	10.039787	10.131532	9.868468	15	29
32	23	9.828716	10.171284	9.960277	10.039723	10.131560	9.868440	37	28
33	15	9.828751	10.171249	9.960340	10.039660	10.131589	9.868411	45	27
34	30	9.828785	10.171215	9.960404	10.039596	10.131618	9.868382	30	26
35	45	9.828820	10.171180	9.960467	10.039533	10.131647	9.868353	15	25
36	24	9.828855	10.171145	9.960530	10.039470	10.131676	9.868324	36	24
37	15	9.828889	10.171111	9.960594	10.039406	10.131705	9.868295	45	23
38	30	9.828924	10.171076	9.960657	10.039343	10.131734	9.868266	30	22
39	45	9.828958	10.171042	9.960721	10.039279	10.131762	9.868238	15	21
40	25	9.828993	10.171007	9.960784	10.039216	10.131791	9.868209	35	20
41	15	9.829028	10.170972	9.960848	10.039152	10.131820	9.868180	45	19
42	30	9.829062	10.170938	9.960911	10.039089	10.131849	9.868151	30	18
43	45	9.829097	10.170903	9.960974	10.039026	10.131878	9.868122	15	17
44	26	9.829131	10.170869	9.961038	10.038962	10.131907	9.868093	34	16
45	15	9.829166	10.170834	9.961101	10.038899	10.131936	9.868064	45	15
46	30	9.829200	10.170800	9.961165	10.038835	10.131964	9.868036	30	14
47	45	9.829235	10.170765	9.961228	10.038772	10.131993	9.868007	15	13
48	27	9.829269	10.170731	9.961291	10.038709	10.132022	9.867978	33	12
49	15	9.829304	10.170696	9.961355	10.038645	10.132051	9.867949	45	11
50	30	9.829338	10.170662	9.961418	10.038582	10.132080	9.867920	30	10
51	45	9.829373	10.170627	9.961482	10.038518	10.132109	9.867891	15	9
52	28	9.829407	10.170593	9.961545	10.038455	10.132138	9.867862	32	8
53	15	9.829442	10.170558	9.961609	10.038391	10.132167	9.867833	45	7
54	30	9.829476	10.170524	9.961672	10.038328	10.132196	9.867804	30	6
55	45	9.829511	10.170489	9.961735	10.038265	10.132225	9.867775	15	5
56	29	9.829545	10.170455	9.961799	10.038201	10.132253	9.867747	31	4
57	15	9.829580	10.170420	9.961862	10.038138	10.132282	9.867718	45	3
58	30	9.829614	10.170386	9.961926	10.038074	10.132311	9.867689	30	2
59	45	9.829649	10.170351	9.961989	10.038011	10.132340	9.867660	15	1
60	30	9.829683	10.170317	9.962052	10.037948	10.132369	9.867631	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 10 ^m .		LOG. SINES, &c.						47 deg.	

2 ^h 50 ^m .		LOG. SINES, &c. (t.)						42 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	'	sec.
0	30	9.829683	10.170317	9.962052	10.037948	10.132369	9.867631	30		60
1	15	9.829718	10.170282	9.962116	10.037884	10.132398	9.867602	45		59
2	30	9.829752	10.170248	9.962179	10.037821	10.132427	9.867573	30		58
3	45	9.829787	10.170213	9.962243	10.037757	10.132456	9.867544	15		57
4	31	9.829821	10.170179	9.962306	10.037694	10.132485	9.867515		29	56
5	15	9.829856	10.170144	9.962369	10.037631	10.132514	9.867486	45		55
6	30	9.829890	10.170110	9.962433	10.037567	10.132543	9.867457	30		54
7	45	9.829924	10.170076	9.962496	10.037504	10.132572	9.867428	15		53
8	32	9.829959	10.170041	9.962560	10.037440	10.132601	9.867399		28	52
9	15	9.829993	10.170007	9.962623	10.037377	10.132630	9.867370	45		51
10	30	9.830028	10.169972	9.962686	10.037314	10.132659	9.867341	30		50
11	45	9.830062	10.169938	9.962750	10.037250	10.132688	9.867312	15		49
12	33	9.830097	10.169903	9.962813	10.037187	10.132717	9.867283		27	48
13	15	9.830131	10.169869	9.962877	10.037123	10.132746	9.867254	45		47
14	30	9.830165	10.169835	9.962940	10.037060	10.132775	9.867225	30		46
15	45	9.830200	10.169800	9.963003	10.036997	10.132804	9.867196	15		45
16	34	9.830234	10.169766	9.963067	10.036933	10.132833	9.867167		26	44
17	15	9.830269	10.169731	9.963130	10.036870	10.132862	9.867138	45		43
18	30	9.830303	10.169697	9.963194	10.036806	10.132891	9.867109	30		42
19	45	9.830337	10.169663	9.963257	10.036743	10.132920	9.867080	15		41
20	35	9.830372	10.169628	9.963320	10.036680	10.132949	9.867051		25	40
21	15	9.830406	10.169594	9.963384	10.036616	10.132978	9.867022	45		39
22	30	9.830440	10.169560	9.963447	10.036553	10.133007	9.866993	30		38
23	45	9.830475	10.169525	9.963511	10.036489	10.133036	9.866964	15		37
24	36	9.830509	10.169491	9.963574	10.036426	10.133065	9.866935		24	36
25	15	9.830543	10.169457	9.963637	10.036363	10.133094	9.866906	45		35
26	30	9.830578	10.169422	9.963701	10.036299	10.133123	9.866877	30		34
27	45	9.830612	10.169388	9.963764	10.036236	10.133152	9.866848	15		33
28	37	9.830646	10.169354	9.963827	10.036173	10.133181	9.866819		23	32
29	15	9.830681	10.169319	9.963891	10.036109	10.133210	9.866790	45		31
30	30	9.830715	10.169285	9.963954	10.036046	10.133239	9.866761	30		30
31	45	9.830749	10.169251	9.964018	10.035982	10.133268	9.866732	15		29
32	38	9.830784	10.169216	9.964081	10.035919	10.133297	9.866703		22	28
33	15	9.830818	10.169182	9.964144	10.035856	10.133326	9.866674	45		27
34	30	9.830852	10.169148	9.964208	10.035792	10.133356	9.866645	30		26
35	45	9.830887	10.169113	9.964271	10.035729	10.133385	9.866615	15		25
36	39	9.830921	10.169079	9.964335	10.035665	10.133414	9.866586		21	24
37	15	9.830955	10.169045	9.964398	10.035602	10.133443	9.866557	45		23
38	30	9.830989	10.169011	9.964461	10.035539	10.133472	9.866528	30		22
39	45	9.831024	10.168976	9.964525	10.035475	10.133501	9.866499	15		21
40	40	9.831058	10.168942	9.964588	10.035412	10.133530	9.866470		20	20
41	15	9.831092	10.168908	9.964651	10.035349	10.133559	9.866441	45		19
42	30	9.831126	10.168874	9.964715	10.035285	10.133588	9.866412	30		18
43	45	9.831161	10.168839	9.964778	10.035222	10.133618	9.866382	15		17
44	41	9.831195	10.168805	9.964842	10.035158	10.133647	9.866353		19	16
45	15	9.831229	10.168771	9.964905	10.035095	10.133676	9.866324	45		15
46	30	9.831263	10.168737	9.964968	10.035032	10.133705	9.866295	30		14
47	45	9.831298	10.168702	9.965032	10.034968	10.133734	9.866266	15		13
48	42	9.831332	10.168668	9.965095	10.034905	10.133763	9.866237		18	12
49	15	9.831366	10.168634	9.965158	10.034842	10.133792	9.866208	45		11
50	30	9.831400	10.168600	9.965222	10.034778	10.133821	9.866179	30		10
51	45	9.831435	10.168565	9.965285	10.034715	10.133851	9.866149	15		9
52	43	9.831469	10.168531	9.965349	10.034651	10.133880	9.866120		17	8
53	15	9.831503	10.168497	9.965412	10.034588	10.133909	9.866091	45		7
54	30	9.831537	10.168463	9.965475	10.034525	10.133938	9.866062	30		6
55	45	9.831571	10.168429	9.965539	10.034461	10.133967	9.866033	15		5
56	44	9.831606	10.168394	9.965602	10.034398	10.133996	9.866004		16	4
57	15	9.831640	10.168360	9.965665	10.034335	10.134026	9.865974	45		3
58	30	9.831674	10.168326	9.965729	10.034271	10.134055	9.865945	30		2
59	45	9.831708	10.168292	9.965792	10.034208	10.134084	9.865916	15		1
60	45	9.831742	10.168258	9.965855	10.034145	10.134113	9.865887		15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	'	sec.
3 ^h 9 ^m .		LOG. SINES, &c.						47 deg.		

2 ^h 51 ^m .		LOG. SINES, &c. (t.)						42 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.831742	10.168258	9.965855	10.034145	10.134113	9.865887	15	60
1	15	9.831776	10.168224	9.965919	10.034081	10.134142	9.865858	45	59
2	30	9.831811	10.168189	9.965982	10.034018	10.134172	9.865828	30	58
3	45	9.831845	10.168155	9.966045	10.033955	10.134201	9.865799	15	57
4	46	9.831879	10.168121	9.966109	10.033891	10.134230	9.865770	14	56
5	15	9.831913	10.168087	9.966172	10.033828	10.134259	9.865741	45	55
6	30	9.831947	10.168053	9.966236	10.033764	10.134288	9.865712	30	54
7	45	9.831981	10.168019	9.966299	10.033701	10.134318	9.865682	15	53
8	47	9.832015	10.167985	9.966362	10.033638	10.134347	9.865653	13	52
9	15	9.832050	10.167950	9.966426	10.033574	10.134376	9.865624	45	51
10	30	9.832084	10.167916	9.966489	10.033511	10.134405	9.865595	30	50
11	45	9.832118	10.167882	9.966552	10.033448	10.134435	9.865565	15	49
12	48	9.832152	10.167848	9.966616	10.033384	10.134464	9.865536	12	48
13	15	9.832186	10.167814	9.966679	10.033321	10.134493	9.865507	45	47
14	30	9.832220	10.167780	9.966742	10.033258	10.134522	9.865478	30	46
15	45	9.832254	10.167746	9.966806	10.033194	10.134552	9.865448	15	45
16	49	9.832288	10.167712	9.966869	10.033131	10.134581	9.865419	11	44
17	15	9.832322	10.167678	9.966932	10.033068	10.134610	9.865390	45	43
18	30	9.832356	10.167644	9.966996	10.033004	10.134639	9.865361	30	42
19	45	9.832391	10.167609	9.967059	10.032941	10.134669	9.865331	15	41
20	50	9.832425	10.167575	9.967122	10.032878	10.134698	9.865302	10	40
21	15	9.832459	10.167541	9.967186	10.032814	10.134727	9.865273	45	39
22	30	9.832493	10.167507	9.967249	10.032751	10.134757	9.865243	30	38
23	45	9.832527	10.167473	9.967313	10.032687	10.134786	9.865214	15	37
24	51	9.832561	10.167439	9.967376	10.032624	10.134815	9.865185	9	36
25	15	9.832595	10.167405	9.967439	10.032561	10.134844	9.865156	45	35
26	30	9.832629	10.167371	9.967503	10.032497	10.134874	9.865126	30	34
27	45	9.832663	10.167337	9.967566	10.032434	10.134903	9.865097	15	33
28	52	9.832697	10.167303	9.967629	10.032371	10.134932	9.865068	8	32
29	15	9.832731	10.167269	9.967693	10.032307	10.134962	9.865038	45	31
30	30	9.832765	10.167235	9.967756	10.032244	10.134991	9.865009	30	30
31	45	9.832799	10.167201	9.967819	10.032181	10.135020	9.864980	15	29
32	53	9.832833	10.167167	9.967883	10.032117	10.135050	9.864950	7	28
33	15	9.832867	10.167133	9.967946	10.032054	10.135079	9.864921	45	27
34	30	9.832901	10.167099	9.968009	10.031991	10.135108	9.864892	30	26
35	45	9.832935	10.167065	9.968073	10.031927	10.135138	9.864862	15	25
36	54	9.832969	10.167031	9.968136	10.031864	10.135167	9.864833	6	24
37	15	9.833003	10.166997	9.968199	10.031801	10.135196	9.864804	45	23
38	30	9.833037	10.166963	9.968263	10.031737	10.135226	9.864774	30	22
39	45	9.833071	10.166929	9.968326	10.031674	10.135255	9.864745	15	21
40	55	9.833105	10.166895	9.968389	10.031611	10.135284	9.864716	5	20
41	15	9.833139	10.166861	9.968453	10.031547	10.135314	9.864686	45	19
42	30	9.833173	10.166827	9.968516	10.031484	10.135343	9.864657	30	18
43	45	9.833207	10.166793	9.968579	10.031421	10.135373	9.864627	15	17
44	56	9.833241	10.166759	9.968643	10.031357	10.135402	9.864598	4	16
45	15	9.833275	10.166725	9.968706	10.031294	10.135431	9.864569	45	15
46	30	9.833309	10.166691	9.968769	10.031231	10.135461	9.864539	30	14
47	45	9.833343	10.166657	9.968833	10.031167	10.135490	9.864510	15	13
48	57	9.833377	10.166623	9.968896	10.031104	10.135519	9.864481	3	12
49	15	9.833410	10.166590	9.968959	10.031041	10.135549	9.864451	45	11
50	30	9.833444	10.166556	9.969023	10.030977	10.135578	9.864422	30	10
51	45	9.833478	10.166522	9.969086	10.030914	10.135608	9.864392	15	9
52	58	9.833512	10.166488	9.969149	10.030851	10.135637	9.864363	2	8
53	15	9.833546	10.166454	9.969213	10.030787	10.135667	9.864333	45	7
54	30	9.833580	10.166420	9.969276	10.030724	10.135696	9.864304	30	6
55	45	9.833614	10.166386	9.969339	10.030661	10.135725	9.864275	15	5
56	59	9.833648	10.166352	9.969403	10.030597	10.135755	9.864245	1	4
57	15	9.833682	10.166318	9.969466	10.030534	10.135784	9.864216	45	3
58	30	9.833716	10.166284	9.969529	10.030471	10.135814	9.864186	30	2
59	45	9.833749	10.166251	9.969592	10.030408	10.135843	9.864157	15	1
60	60	9.833783	10.166217	9.969656	10.030344	10.135873	9.864127	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 8 ^m .		LOG. SINES, &c.						47 deg.	

2 ^h 52 ^m .		LOG. SINES, &c. (t.)						43 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	0	9.833783	10.166217	9.969656	10.030344	10.135873	9.864127	60	60
1	15	9.833817	10.166183	9.969719	10.030281	10.135902	9.864098	45	59
2	30	9.833851	10.166149	9.969782	10.030218	10.135931	9.864069	30	58
3	45	9.833885	10.166115	9.969846	10.030154	10.135961	9.864039	15	57
4	1	9.833919	10.166081	9.969909	10.030091	10.135990	9.864010	59	56
5	15	9.833953	10.166047	9.969972	10.030028	10.136020	9.863980	45	55
6	30	9.833986	10.166014	9.970036	10.029964	10.136049	9.863951	30	54
7	45	9.834020	10.165980	9.970099	10.029901	10.136079	9.863921	15	53
8	2	9.834054	10.165946	9.970162	10.029838	10.136108	9.863892	58	52
9	15	9.834088	10.165912	9.970226	10.029774	10.136138	9.863862	45	51
10	30	9.834122	10.165878	9.970289	10.029711	10.136167	9.863833	30	50
11	45	9.834156	10.165844	9.970352	10.029648	10.136197	9.863803	15	49
12	3	9.834189	10.165811	9.970416	10.029584	10.136226	9.863774	57	48
13	15	9.834223	10.165777	9.970479	10.029521	10.136256	9.863744	45	47
14	30	9.834257	10.165743	9.970542	10.029458	10.136285	9.863715	30	46
15	45	9.834291	10.165709	9.970606	10.029394	10.136315	9.863685	15	45
16	4	9.834325	10.165675	9.970669	10.029331	10.136344	9.863656	56	44
17	15	9.834358	10.165642	9.970732	10.029268	10.136374	9.863626	45	43
18	30	9.834392	10.165608	9.970795	10.029205	10.136403	9.863597	30	42
19	45	9.834426	10.165574	9.970859	10.029141	10.136433	9.863567	15	41
20	5	9.834460	10.165540	9.970922	10.029078	10.136462	9.863538	55	40
21	15	9.834493	10.165507	9.970985	10.029015	10.136492	9.863508	45	39
22	30	9.834527	10.165473	9.971049	10.028951	10.136522	9.863478	30	38
23	45	9.834561	10.165439	9.971112	10.028888	10.136551	9.863449	15	37
24	6	9.834595	10.165405	9.971175	10.028825	10.136581	9.863419	54	36
25	15	9.834628	10.165372	9.971239	10.028761	10.136610	9.863390	45	35
26	30	9.834662	10.165338	9.971302	10.028698	10.136640	9.863360	30	34
27	45	9.834696	10.165304	9.971365	10.028635	10.136669	9.863331	15	33
28	7	9.834730	10.165270	9.971429	10.028571	10.136699	9.863301	53	32
29	15	9.834763	10.165237	9.971492	10.028508	10.136728	9.863272	45	31
30	30	9.834797	10.165203	9.971555	10.028445	10.136758	9.863242	30	30
31	45	9.834831	10.165169	9.971618	10.028382	10.136788	9.863212	15	29
32	8	9.834865	10.165135	9.971682	10.028318	10.136817	9.863183	52	28
33	15	9.834898	10.165102	9.971745	10.028255	10.136847	9.863153	45	27
34	30	9.834932	10.165068	9.971808	10.028192	10.136876	9.863124	30	26
35	45	9.834966	10.165034	9.971872	10.028128	10.136906	9.863094	15	25
36	9	9.834999	10.165001	9.971935	10.028065	10.136936	9.863064	51	24
37	15	9.835033	10.164967	9.971998	10.028002	10.136965	9.863035	45	23
38	30	9.835067	10.164933	9.972062	10.027938	10.136995	9.863005	30	22
39	45	9.835100	10.164900	9.972125	10.027875	10.137024	9.862976	15	21
40	10	9.835134	10.164866	9.972188	10.027812	10.137054	9.862946	50	20
41	15	9.835168	10.164832	9.972251	10.027749	10.137084	9.862916	45	19
42	30	9.835201	10.164799	9.972315	10.027685	10.137113	9.862887	30	18
43	45	9.835235	10.164765	9.972378	10.027622	10.137143	9.862857	15	17
44	11	9.835269	10.164731	9.972441	10.027559	10.137173	9.862827	49	16
45	15	9.835302	10.164698	9.972505	10.027495	10.137202	9.862798	45	15
46	30	9.835336	10.164664	9.972568	10.027432	10.137232	9.862768	30	14
47	45	9.835370	10.164630	9.972631	10.027369	10.137262	9.862738	15	13
48	12	9.835403	10.164597	9.972694	10.027306	10.137291	9.862709	48	12
49	15	9.835437	10.164563	9.972758	10.027242	10.137321	9.862679	45	11
50	30	9.835471	10.164529	9.972821	10.027179	10.137351	9.862649	30	10
51	45	9.835504	10.164496	9.972884	10.027116	10.137380	9.862620	15	9
52	13	9.835538	10.164462	9.972948	10.027052	10.137410	9.862590	47	8
53	15	9.835571	10.164429	9.973011	10.026989	10.137440	9.862560	45	7
54	30	9.835605	10.164395	9.973074	10.026926	10.137469	9.862531	30	6
55	45	9.835639	10.164361	9.973137	10.026863	10.137499	9.862501	15	5
56	14	9.835672	10.164328	9.973201	10.026799	10.137529	9.862471	46	4
57	15	9.835706	10.164294	9.973264	10.026736	10.137558	9.862442	45	3
58	30	9.835739	10.164261	9.973327	10.026673	10.137588	9.862412	30	2
59	45	9.835773	10.164227	9.973391	10.026609	10.137618	9.862382	15	1
60	15	9.835807	10.164193	9.973454	10.026546	10.137647	9.862353	45	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 7 ^m .		LOG. SINES, &c.						46 deg.	

2 ^h 53 ^m .		LOG. SINES, &c. (t.)						43 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.835807	10.164193	9.973454	10.026546	10.137647	9.862353	45	60
1	15	9.835840	10.164160	9.973517	10.026483	10.137677	9.862323	45	59
2	30	9.835874	10.164126	9.973580	10.026420	10.137707	9.862293	30	58
3	45	9.835907	10.164093	9.973644	10.026356	10.137737	9.862263	15	57
4	16	9.835941	10.164059	9.973707	10.026293	10.137766	9.862234	44	56
5	15	9.835974	10.164026	9.973770	10.026230	10.137796	9.862204	45	55
6	30	9.836008	10.163992	9.973834	10.026166	10.137826	9.862174	30	54
7	45	9.836041	10.163959	9.973897	10.026103	10.137855	9.862145	15	53
8	17	9.836075	10.163925	9.973960	10.026040	10.137885	9.862115	43	52
9	15	9.836108	10.163892	9.974023	10.025977	10.137915	9.862085	45	51
10	30	9.836142	10.163858	9.974087	10.025913	10.137945	9.862055	30	50
11	45	9.836176	10.163824	9.974150	10.025850	10.137974	9.862026	15	49
12	18	9.836209	10.163791	9.974213	10.025787	10.138004	9.861996	42	48
13	15	9.836243	10.163757	9.974277	10.025723	10.138034	9.861966	45	47
14	30	9.836276	10.163724	9.974340	10.025660	10.138064	9.861936	30	46
15	45	9.836310	10.163690	9.974403	10.025597	10.138094	9.861906	15	45
16	19	9.836343	10.163657	9.974466	10.025534	10.138123	9.861877	41	44
17	15	9.836377	10.163623	9.974530	10.025470	10.138153	9.861847	45	43
18	30	9.836410	10.163590	9.974593	10.025407	10.138183	9.861817	30	42
19	45	9.836444	10.163556	9.974656	10.025344	10.138213	9.861787	15	41
20	20	9.836477	10.163523	9.974719	10.025281	10.138242	9.861758	40	40
21	15	9.836510	10.163490	9.974783	10.025217	10.138272	9.861728	45	39
22	30	9.836544	10.163456	9.974846	10.025154	10.138302	9.861698	30	38
23	45	9.836577	10.163423	9.974909	10.025091	10.138332	9.861668	15	37
24	21	9.836611	10.163389	9.974973	10.025027	10.138362	9.861638	39	36
25	15	9.836644	10.163356	9.975036	10.024964	10.138392	9.861608	45	35
26	30	9.836678	10.163322	9.975099	10.024901	10.138421	9.861579	30	34
27	45	9.836711	10.163289	9.975162	10.024838	10.138451	9.861549	15	33
28	22	9.836745	10.163255	9.975226	10.024774	10.138481	9.861519	38	32
29	15	9.836778	10.163222	9.975289	10.024711	10.138511	9.861489	45	31
30	30	9.836812	10.163188	9.975352	10.024648	10.138541	9.861459	30	30
31	45	9.836845	10.163155	9.975415	10.024585	10.138571	9.861429	15	29
32	23	9.836878	10.163122	9.975479	10.024521	10.138600	9.861400	37	28
33	15	9.836912	10.163088	9.975542	10.024458	10.138630	9.861370	45	27
34	30	9.836945	10.163055	9.975605	10.024395	10.138660	9.861340	30	26
35	45	9.836979	10.163021	9.975668	10.024332	10.138690	9.861310	15	25
36	24	9.837012	10.162988	9.975732	10.024268	10.138720	9.861280	36	24
37	15	9.837045	10.162955	9.975795	10.024205	10.138750	9.861250	45	23
38	30	9.837079	10.162921	9.975858	10.024142	10.138780	9.861220	30	22
39	45	9.837112	10.162888	9.975922	10.024078	10.138809	9.861191	15	21
40	25	9.837146	10.162854	9.975985	10.024015	10.138839	9.861161	35	20
41	15	9.837179	10.162821	9.976048	10.023952	10.138869	9.861131	45	19
42	30	9.837212	10.162788	9.976111	10.023889	10.138899	9.861101	30	18
43	45	9.837246	10.162754	9.976175	10.023825	10.138929	9.861071	15	17
44	26	9.837279	10.162721	9.976238	10.023762	10.138959	9.861041	34	16
45	15	9.837312	10.162688	9.976301	10.023699	10.138989	9.861011	45	15
46	30	9.837346	10.162654	9.976364	10.023636	10.139019	9.860981	30	14
47	45	9.837379	10.162621	9.976428	10.023572	10.139049	9.860951	15	13
48	27	9.837412	10.162588	9.976491	10.023509	10.139079	9.860921	33	12
49	15	9.837446	10.162554	9.976554	10.023446	10.139108	9.860892	45	11
50	30	9.837479	10.162521	9.976617	10.023383	10.139138	9.860862	30	10
51	45	9.837512	10.162488	9.976681	10.023319	10.139168	9.860832	15	9
52	28	9.837546	10.162454	9.976744	10.023256	10.139198	9.860802	32	8
53	15	9.837579	10.162421	9.976807	10.023193	10.139228	9.860772	45	7
54	30	9.837612	10.162388	9.976870	10.023130	10.139258	9.860742	30	6
55	45	9.837646	10.162354	9.976934	10.023066	10.139288	9.860712	15	5
56	29	9.837679	10.162321	9.976997	10.023003	10.139318	9.860682	31	4
57	15	9.837712	10.162288	9.977060	10.022940	10.139348	9.860652	45	3
58	30	9.837746	10.162254	9.977123	10.022877	10.139378	9.860622	30	2
59	45	9.837779	10.162221	9.977187	10.022813	10.139408	9.860592	15	1
60	30	9.837812	10.162188	9.977250	10.022750	10.139438	9.860562	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.

3^h 6^m.

LOG. SINES, &c.

46 deg.

2 ^d 54 ^m .		LOG. SINES, &c. (t.)						43 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	30	9.837812	10.162188	9.977250	10.022750	10.139438	9.860562	30	60
1	15	9.837845	10.162155	9.977313	10.022687	10.139468	9.860532	45	59
2	30	9.837879	10.162121	9.977376	10.022624	10.139498	9.860502	30	58
3	45	9.837912	10.162088	9.977440	10.022560	10.139528	9.860472	15	57
4	31	9.837945	10.162055	9.977503	10.022497	10.139558	9.860442	29	56
5	15	9.837978	10.162022	9.977566	10.022434	10.139588	9.860412	45	55
6	30	9.838012	10.161988	9.977629	10.022371	10.139618	9.860382	30	54
7	45	9.838045	10.161955	9.977693	10.022307	10.139648	9.860352	15	53
8	32	9.838078	10.161922	9.977756	10.022244	10.139678	9.860322	28	52
9	15	9.838111	10.161889	9.977819	10.022181	10.139708	9.860292	45	51
10	30	9.838145	10.161855	9.977882	10.022118	10.139738	9.860262	30	50
11	45	9.838178	10.161822	9.977946	10.022054	10.139768	9.860232	15	49
12	33	9.838211	10.161789	9.978009	10.021991	10.139798	9.860202	27	48
13	15	9.838244	10.161756	9.978072	10.021928	10.139828	9.860172	45	47
14	30	9.838278	10.161722	9.978135	10.021865	10.139858	9.860142	30	46
15	45	9.838311	10.161689	9.978199	10.021801	10.139888	9.860112	15	45
16	34	9.838344	10.161656	9.978262	10.021738	10.139918	9.860082	26	44
17	15	9.838377	10.161623	9.978325	10.021675	10.139948	9.860052	45	43
18	30	9.838410	10.161590	9.978388	10.021612	10.139978	9.860022	30	42
19	45	9.838444	10.161556	9.978452	10.021548	10.140008	9.859992	15	41
20	35	9.838477	10.161523	9.978515	10.021485	10.140038	9.859962	25	40
21	15	9.838510	10.161490	9.978578	10.021422	10.140068	9.859932	45	39
22	30	9.838543	10.161457	9.978641	10.021359	10.140098	9.859902	30	38
23	45	9.838576	10.161424	9.978705	10.021295	10.140128	9.859872	15	37
24	36	9.838610	10.161390	9.978768	10.021232	10.140158	9.859842	24	36
25	15	9.838643	10.161357	9.978831	10.021169	10.140188	9.859812	45	35
26	30	9.838676	10.161324	9.978894	10.021106	10.140219	9.859781	30	34
27	45	9.838709	10.161291	9.978958	10.021042	10.140249	9.859751	15	33
28	37	9.838742	10.161258	9.979021	10.020979	10.140279	9.859721	23	32
29	15	9.838775	10.161225	9.979084	10.020916	10.140309	9.859691	45	31
30	30	9.838808	10.161192	9.979147	10.020853	10.140339	9.859661	30	30
31	45	9.838842	10.161158	9.979211	10.020789	10.140369	9.859631	15	29
32	38	9.838875	10.161125	9.979274	10.020726	10.140399	9.859601	22	28
33	15	9.838908	10.161092	9.979337	10.020663	10.140429	9.859571	45	27
34	30	9.838941	10.161059	9.979400	10.020600	10.140459	9.859541	30	26
35	45	9.838974	10.161026	9.979463	10.020537	10.140490	9.859510	15	25
36	39	9.839007	10.160993	9.979527	10.020473	10.140520	9.859480	21	24
37	15	9.839040	10.160960	9.979590	10.020410	10.140550	9.859450	45	23
38	30	9.839073	10.160927	9.979653	10.020347	10.140580	9.859420	30	22
39	45	9.839106	10.160894	9.979716	10.020284	10.140610	9.859390	15	21
40	40	9.839140	10.160860	9.979780	10.020220	10.140640	9.859360	20	20
41	15	9.839173	10.160827	9.979843	10.020157	10.140670	9.859330	45	19
42	30	9.839206	10.160794	9.979906	10.020094	10.140700	9.859300	30	18
43	45	9.839239	10.160761	9.979969	10.020031	10.140731	9.859269	15	17
44	41	9.839272	10.160728	9.980033	10.019967	10.140761	9.859239	19	16
45	15	9.839305	10.160695	9.980096	10.019904	10.140791	9.859209	45	15
46	30	9.839338	10.160662	9.980159	10.019841	10.140821	9.859179	30	14
47	45	9.839371	10.160629	9.980222	10.019778	10.140851	9.859149	15	13
48	42	9.839404	10.160596	9.980286	10.019714	10.140881	9.859119	18	12
49	15	9.839437	10.160563	9.980349	10.019651	10.140912	9.859088	45	11
50	30	9.839470	10.160530	9.980412	10.019588	10.140942	9.859058	30	10
51	45	9.839503	10.160497	9.980475	10.019525	10.140972	9.859028	15	9
52	43	9.839536	10.160464	9.980538	10.019462	10.141002	9.858998	17	8
53	15	9.839569	10.160431	9.980602	10.019398	10.141032	9.858968	45	7
54	30	9.839602	10.160398	9.980665	10.019335	10.141063	9.858937	30	6
55	45	9.839635	10.160365	9.980728	10.019272	10.141093	9.858907	15	5
56	44	9.839668	10.160332	9.980791	10.019209	10.141123	9.858877	16	4
57	15	9.839701	10.160299	9.980855	10.019145	10.141153	9.858847	45	3
58	30	9.839734	10.160266	9.980918	10.019082	10.141184	9.858816	30	2
59	45	9.839767	10.160233	9.980981	10.019019	10.141214	9.858786	15	1
60	45	9.839800	10.160200	9.981044	10.018956	10.141244	9.858756	15	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 5 ^m .		LOG. SINES, &c.						46 deg.	

2 ^h 55 ^m .		LOG. SINES, &c. (t.)						43 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.839300	10.160200	9.981044	10.018956	10.141244	9.858756	15	60
1	15	9.839333	10.160167	9.981107	10.018893	10.141274	9.858726	45	59
2	30	9.839366	10.160134	9.981171	10.018829	10.141304	9.858696	30	58
3	45	9.839399	10.160101	9.981234	10.018766	10.141335	9.858665	15	57
4	46	9.839332	10.160068	9.981297	10.018703	10.141365	9.858635	14	56
5	15	9.839365	10.160035	9.981360	10.018640	10.141395	9.858605	45	55
6	30	9.839398	10.160002	9.981424	10.018576	10.141425	9.858575	30	54
7	45	9.840031	10.159969	9.981487	10.018513	10.141456	9.858544	15	53
8	47	9.840064	10.159936	9.981550	10.018450	10.141486	9.858514	13	52
9	15	9.840097	10.159903	9.981613	10.018387	10.141516	9.858484	45	51
10	30	9.840130	10.159870	9.981677	10.018323	10.141547	9.858453	30	50
11	45	9.840163	10.159837	9.981740	10.018260	10.141577	9.858423	15	49
12	48	9.840196	10.159804	9.981803	10.018197	10.141607	9.858393	12	48
13	15	9.840229	10.159771	9.981866	10.018134	10.141637	9.858363	45	47
14	30	9.840262	10.159738	9.981929	10.018071	10.141668	9.858332	30	46
15	45	9.840295	10.159705	9.981993	10.018007	10.141698	9.858302	15	45
16	49	9.840328	10.159672	9.982056	10.017944	10.141728	9.858272	11	44
17	15	9.840361	10.159639	9.982119	10.017881	10.141759	9.858241	45	43
18	30	9.840393	10.159607	9.982182	10.017818	10.141789	9.858211	30	42
19	45	9.840426	10.159574	9.982245	10.017755	10.141819	9.858181	15	41
20	50	9.840459	10.159541	9.982309	10.017691	10.141850	9.858150	10	40
21	15	9.840492	10.159508	9.982372	10.017628	10.141880	9.858120	45	39
22	30	9.840525	10.159475	9.982435	10.017565	10.141910	9.858090	30	38
23	45	9.840558	10.159442	9.982498	10.017502	10.141941	9.858059	15	37
24	51	9.840591	10.159409	9.982562	10.017438	10.141971	9.858029	9	36
25	15	9.840624	10.159376	9.982625	10.017375	10.142001	9.857999	45	35
26	30	9.840656	10.159344	9.982688	10.017312	10.142032	9.857968	30	34
27	45	9.840689	10.159311	9.982751	10.017249	10.142062	9.857938	15	33
28	52	9.840722	10.159278	9.982814	10.017186	10.142092	9.857908	8	32
29	15	9.840755	10.159245	9.982878	10.017122	10.142123	9.857877	45	31
30	30	9.840788	10.159212	9.982941	10.017059	10.142153	9.857847	30	30
31	45	9.840821	10.159179	9.983004	10.016996	10.142183	9.857817	15	29
32	53	9.840854	10.159146	9.983067	10.016933	10.142214	9.857786	7	28
33	15	9.840886	10.159114	9.983131	10.016869	10.142244	9.857756	45	27
34	30	9.840919	10.159081	9.983194	10.016806	10.142274	9.857726	30	26
35	45	9.840952	10.159048	9.983257	10.016743	10.142305	9.857695	15	25
36	54	9.840985	10.159015	9.983320	10.016680	10.142335	9.857665	6	24
37	15	9.841018	10.158982	9.983383	10.016617	10.142366	9.857634	45	23
38	30	9.841051	10.158949	9.983447	10.016553	10.142396	9.857604	30	22
39	45	9.841083	10.158917	9.983510	10.016490	10.142426	9.857574	15	21
40	55	9.841116	10.158884	9.983573	10.016427	10.142457	9.857543	5	20
41	15	9.841149	10.158851	9.983636	10.016364	10.142487	9.857513	45	19
42	30	9.841182	10.158818	9.983699	10.016301	10.142518	9.857482	30	18
43	45	9.841215	10.158785	9.983763	10.016237	10.142548	9.857452	15	17
44	56	9.841247	10.158753	9.983826	10.016174	10.142579	9.857421	4	16
45	15	9.841280	10.158720	9.983889	10.016111	10.142609	9.857391	45	15
46	30	9.841313	10.158687	9.983952	10.016048	10.142639	9.857361	30	14
47	45	9.841346	10.158654	9.984015	10.015985	10.142670	9.857330	15	13
48	57	9.841378	10.158622	9.984079	10.015921	10.142700	9.857300	3	12
49	15	9.841411	10.158589	9.984142	10.015858	10.142731	9.857269	45	11
50	30	9.841444	10.158556	9.984205	10.015795	10.142761	9.857239	30	10
51	45	9.841477	10.158523	9.984268	10.015732	10.142792	9.857208	15	9
52	58	9.841509	10.158491	9.984331	10.015669	10.142822	9.857178	2	8
53	15	9.841542	10.158458	9.984395	10.015605	10.142853	9.857147	45	7
54	30	9.841575	10.158425	9.984458	10.015542	10.142883	9.857117	30	6
55	45	9.841608	10.158392	9.984521	10.015479	10.142914	9.857086	15	5
56	59	9.841640	10.158360	9.984584	10.015416	10.142944	9.857056	1	4
57	15	9.841673	10.158327	9.984648	10.015352	10.142974	9.857026	45	3
58	30	9.841706	10.158294	9.984711	10.015289	10.143005	9.856995	30	2
59	45	9.841739	10.158261	9.984774	10.015226	10.143035	9.856965	15	1
60	60	9.841771	10.158229	9.984837	10.015163	10.143066	9.856934	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 4 ^m .		LOG. SINES, &c.						46 deg.	

2^h 56^m.

LOG. SINES, &c. (t.)

44 deg.

sec.	'	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	'	"	sec.
0		0	9.841771	10.158229	9.984837	10.015163	10.143066	9.856934		60	60
1		15	9.841804	10.158196	9.984900	10.015100	10.143096	9.856904		45	59
2		30	9.841837	10.158163	9.984964	10.015036	10.143127	9.856873		30	58
3		45	9.841869	10.158131	9.985027	10.014973	10.143157	9.856843		15	57
4		1	9.841902	10.158098	9.985090	10.014910	10.143188	9.856812		59	56
5		15	9.841935	10.158065	9.985153	10.014847	10.143219	9.856781		45	55
6		30	9.841967	10.158033	9.985216	10.014784	10.143249	9.856751		30	54
7		45	9.842000	10.158000	9.985280	10.014720	10.143280	9.856720		15	53
8		2	9.842033	10.157967	9.985343	10.014657	10.143310	9.856690		58	52
9		15	9.842065	10.157935	9.985406	10.014594	10.143341	9.856659		45	51
10		30	9.842098	10.157902	9.985469	10.014531	10.143370	9.856630		30	50
11		45	9.842131	10.157869	9.985532	10.014468	10.143402	9.856598		15	49
12		3	9.842163	10.157837	9.985596	10.014404	10.143432	9.856568		57	48
13		15	9.842196	10.157804	9.985659	10.014341	10.143463	9.856537		45	47
14		30	9.842229	10.157771	9.985722	10.014278	10.143493	9.856507		30	46
15		45	9.842261	10.157739	9.985785	10.014215	10.143524	9.856476		15	45
16		4	9.842294	10.157706	9.985848	10.014152	10.143555	9.856445		56	44
17		15	9.842327	10.157673	9.985912	10.014088	10.143585	9.856415		45	43
18		30	9.842359	10.157641	9.985975	10.014025	10.143616	9.856384		30	42
19		45	9.842392	10.157608	9.986038	10.013962	10.143646	9.856354		15	41
20		5	9.842424	10.157576	9.986101	10.013899	10.143677	9.856323		55	40
21		15	9.842457	10.157543	9.986164	10.013836	10.143707	9.856293		45	39
22		30	9.842490	10.157510	9.986228	10.013772	10.143738	9.856262		30	38
23		45	9.842522	10.157478	9.986291	10.013709	10.143769	9.856231		15	37
24		6	9.842555	10.157445	9.986354	10.013646	10.143799	9.856201		54	36
25		15	9.842587	10.157413	9.986417	10.013583	10.143830	9.856170		45	35
26		30	9.842620	10.157380	9.986480	10.013520	10.143860	9.856140		30	34
27		45	9.842653	10.157347	9.986543	10.013456	10.143891	9.856109		15	33
28		7	9.842685	10.157315	9.986607	10.013393	10.143922	9.856078		53	32
29		15	9.842718	10.157282	9.986670	10.013330	10.143952	9.856048		45	31
30		30	9.842750	10.157250	9.986733	10.013267	10.143983	9.856017		30	30
31		45	9.842783	10.157217	9.986796	10.013204	10.144014	9.855986		15	29
32		8	9.842815	10.157185	9.986860	10.013140	10.144044	9.855956		52	28
33		15	9.842848	10.157152	9.986923	10.013077	10.144075	9.855925		45	27
34		30	9.842880	10.157120	9.986986	10.013014	10.144106	9.855894		30	26
35		45	9.842913	10.157087	9.987049	10.012951	10.144136	9.855864		15	25
36		9	9.842946	10.157054	9.987112	10.012888	10.144167	9.855833		51	24
37		15	9.842978	10.157022	9.987175	10.012825	10.144197	9.855803		45	23
38		30	9.843011	10.156989	9.987239	10.012761	10.144228	9.855772		30	22
39		45	9.843043	10.156957	9.987302	10.012698	10.144259	9.855741		15	21
40		10	9.843076	10.156924	9.987365	10.012635	10.144289	9.855711		50	20
41		15	9.843108	10.156892	9.987428	10.012572	10.144320	9.855680		45	19
42		30	9.843141	10.156859	9.987491	10.012509	10.144351	9.855649		30	18
43		45	9.843173	10.156827	9.987555	10.012445	10.144382	9.855618		15	17
44		11	9.843206	10.156794	9.987618	10.012382	10.144412	9.855588		49	16
45		15	9.843238	10.156762	9.987681	10.012319	10.144443	9.855557		45	15
46		30	9.843271	10.156729	9.987744	10.012256	10.144474	9.855526		30	14
47		45	9.843303	10.156697	9.987807	10.012193	10.144504	9.855496		15	13
48		12	9.843336	10.156664	9.987871	10.012129	10.144535	9.855465		48	12
49		15	9.843368	10.156632	9.987934	10.012066	10.144566	9.855434		45	11
50		30	9.843401	10.156599	9.987997	10.012003	10.144596	9.855404		30	10
51		45	9.843433	10.156567	9.988060	10.011940	10.144627	9.855373		15	9
52		13	9.843465	10.156535	9.988123	10.011877	10.144658	9.855342		47	8
53		15	9.843498	10.156502	9.988187	10.011813	10.144689	9.855311		45	7
54		30	9.843530	10.156470	9.988250	10.011750	10.144719	9.855281		30	6
55		45	9.843563	10.156437	9.988313	10.011687	10.144750	9.855250		15	5
56		14	9.843595	10.156405	9.988376	10.011624	10.144781	9.855219		46	4
57		15	9.843628	10.156372	9.988439	10.011561	10.144812	9.855188		45	3
58		30	9.843660	10.156340	9.988502	10.011498	10.144842	9.855158		30	2
59		45	9.843693	10.156307	9.988566	10.011434	10.144873	9.855127		15	1
60		15	9.843725	10.156275	9.988629	10.011371	10.144904	9.855096		45	0
sec.	'	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	'	"	sec.

3^h 3^m.

LOG. SINES, &c.

45 deg.

2 ^h 57 ^m .		LOG. SINES, &c. (t.)						44 deg.	
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	15	9.843725	10.156275	9.988629	10.011371	10.144904	9.855096	45	60
1	15	9.843757	10.156243	9.988692	10.011308	10.144935	9.855065	45	59
2	30	9.843790	10.156210	9.988755	10.011245	10.144965	9.855035	30	58
3	45	9.843822	10.156178	9.988818	10.011182	10.144996	9.855004	15	57
4	16	9.843855	10.156145	9.988882	10.011118	10.145027	9.854973	44	56
5	15	9.843887	10.156113	9.988945	10.011055	10.145058	9.854942	45	55
6	30	9.843919	10.156081	9.989008	10.010992	10.145089	9.854911	30	54
7	45	9.843952	10.156048	9.989071	10.010929	10.145119	9.854881	15	53
8	17	9.843984	10.156016	9.989134	10.010866	10.145150	9.854850	43	52
9	15	9.844017	10.155983	9.989198	10.010802	10.145181	9.854819	45	51
10	30	9.844049	10.155951	9.989261	10.010739	10.145212	9.854788	30	50
11	45	9.844081	10.155919	9.989324	10.010676	10.145243	9.854757	15	49
12	18	9.844114	10.155886	9.989387	10.010613	10.145273	9.854727	42	48
13	15	9.844146	10.155854	9.989450	10.010550	10.145304	9.854696	45	47
14	30	9.844178	10.155822	9.989513	10.010487	10.145335	9.854665	30	46
15	45	9.844211	10.155789	9.989577	10.010423	10.145366	9.854634	15	45
16	19	9.844243	10.155757	9.989640	10.010360	10.145397	9.854603	41	44
17	15	9.844275	10.155725	9.989703	10.010297	10.145428	9.854572	45	43
18	30	9.844308	10.155692	9.989766	10.010234	10.145458	9.854542	30	42
19	45	9.844340	10.155660	9.989829	10.010171	10.145489	9.854511	15	41
20	20	9.844372	10.155628	9.989893	10.010107	10.145520	9.854480	40	40
21	15	9.844405	10.155595	9.989956	10.010044	10.145551	9.854449	45	39
22	30	9.844437	10.155563	9.990019	10.009981	10.145582	9.854418	30	38
23	45	9.844469	10.155531	9.990082	10.009918	10.145613	9.854387	15	37
24	21	9.844502	10.155498	9.990145	10.009855	10.145644	9.854356	39	36
25	15	9.844534	10.155466	9.990208	10.009792	10.145674	9.854326	45	35
26	30	9.844566	10.155434	9.990272	10.009728	10.145705	9.854295	30	34
27	45	9.844599	10.155401	9.990335	10.009665	10.145736	9.854264	15	33
28	22	9.844631	10.155369	9.990398	10.009602	10.145767	9.854233	38	32
29	15	9.844663	10.155337	9.990461	10.009539	10.145798	9.854202	45	31
30	30	9.844695	10.155305	9.990524	10.009476	10.145829	9.854171	30	30
31	45	9.844728	10.155272	9.990588	10.009412	10.145860	9.854140	15	29
32	23	9.844760	10.155240	9.990651	10.009349	10.145891	9.854109	37	28
33	15	9.844792	10.155208	9.990714	10.009286	10.145922	9.854078	45	27
34	30	9.844825	10.155175	9.990777	10.009223	10.145953	9.854047	30	26
35	45	9.844857	10.155143	9.990840	10.009160	10.145983	9.854017	15	25
36	24	9.844889	10.155111	9.990903	10.009097	10.146014	9.853986	36	24
37	15	9.844921	10.155079	9.990967	10.009033	10.146045	9.853955	45	23
38	30	9.844954	10.155046	9.991030	10.008970	10.146076	9.853924	30	22
39	45	9.844986	10.155014	9.991093	10.008907	10.146107	9.853893	15	21
40	25	9.845018	10.154982	9.991156	10.008844	10.146138	9.853862	35	20
41	15	9.845050	10.154950	9.991219	10.008781	10.146169	9.853831	45	19
42	30	9.845082	10.154918	9.991283	10.008717	10.146200	9.853800	30	18
43	45	9.845115	10.154885	9.991346	10.008654	10.146231	9.853769	15	17
44	26	9.845147	10.154853	9.991409	10.008591	10.146262	9.853738	34	16
45	15	9.845179	10.154821	9.991472	10.008528	10.146293	9.853707	45	15
46	30	9.845211	10.154789	9.991535	10.008465	10.146324	9.853676	30	14
47	45	9.845244	10.154756	9.991598	10.008402	10.146355	9.853645	15	13
48	27	9.845276	10.154724	9.991662	10.008338	10.146386	9.853614	33	12
49	15	9.845308	10.154692	9.991725	10.008275	10.146417	9.853583	45	11
50	30	9.845340	10.154660	9.991788	10.008212	10.146448	9.853552	30	10
51	45	9.845372	10.154628	9.991851	10.008149	10.146479	9.853521	15	9
52	28	9.845404	10.154596	9.991914	10.008086	10.146510	9.853490	32	8
53	15	9.845437	10.154563	9.991977	10.008023	10.146541	9.853459	45	7
54	30	9.845469	10.154531	9.992041	10.007959	10.146572	9.853428	30	6
55	45	9.845501	10.154499	9.992104	10.007896	10.146603	9.853397	15	5
56	29	9.845533	10.154467	9.992167	10.007833	10.146634	9.853366	31	4
57	15	9.845565	10.154435	9.992230	10.007770	10.146665	9.853335	45	3
58	30	9.845597	10.154403	9.992293	10.007707	10.146696	9.853304	30	2
59	45	9.845630	10.154370	9.992357	10.007643	10.146727	9.853273	15	1
60	30	9.845662	10.154338	9.992420	10.007580	10.146758	9.853242	30	0
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.
3 ^h 2 ^m .		LOG. SINES, &c.						45 deg.	

2 ^h 5 ^m .			LOG. SINES, &c. (t.)						44 deg.		
sec.	"	sine.	cosecant.	tangent.	cotangent.	secant.	cosine.	"	sec.		
0	30	9.845662	10.154338	9.992420	10.007580	10.146758	9.853242	30	60		
1	15	9.845694	10.154306	9.992483	10.007517	10.146789	9.853211	45	59		
2	30	9.845726	10.154274	9.992546	10.007454	10.146820	9.853180	30	58		
3	45	9.845758	10.154242	9.992609	10.007391	10.146851	9.853149	15	57		
4	31	9.845790	10.154210	9.992672	10.007328	10.146882	9.853118	29	56		
5	15	9.845822	10.154178	9.992736	10.007264	10.146913	9.853087	45	55		
6	30	9.845854	10.154146	9.992799	10.007201	10.146944	9.853056	30	54		
7	45	9.845887	10.154113	9.992862	10.007138	10.146975	9.853025	15	53		
8	32	9.845919	10.154081	9.992925	10.007075	10.147006	9.852994	28	52		
9	15	9.845951	10.154049	9.992988	10.007012	10.147038	9.852962	45	51		
10	30	9.845983	10.154017	9.993051	10.006949	10.147069	9.852931	30	50		
11	45	9.846015	10.153985	9.993115	10.006885	10.147100	9.852900	15	49		
12	33	9.846047	10.153953	9.993178	10.006822	10.147131	9.852869	27	48		
13	15	9.846079	10.153921	9.993241	10.006759	10.147162	9.852838	45	47		
14	30	9.846111	10.153889	9.993304	10.006696	10.147193	9.852807	30	46		
15	45	9.846143	10.153857	9.993367	10.006633	10.147224	9.852776	15	45		
16	34	9.846175	10.153825	9.993430	10.006570	10.147255	9.852745	26	44		
17	15	9.846207	10.153793	9.993494	10.006506	10.147286	9.852714	45	43		
18	30	9.846239	10.153761	9.993557	10.006443	10.147317	9.852683	30	42		
19	45	9.846272	10.153728	9.993620	10.006380	10.147349	9.852651	15	41		
20	35	9.846304	10.153696	9.993683	10.006317	10.147380	9.852620	25	40		
21	15	9.846336	10.153664	9.993746	10.006254	10.147411	9.852589	45	39		
22	30	9.846368	10.153632	9.993810	10.006190	10.147442	9.852558	30	38		
23	45	9.846400	10.153600	9.993873	10.006127	10.147473	9.852527	15	37		
24	36	9.846432	10.153568	9.993936	10.006064	10.147504	9.852496	24	36		
25	15	9.846464	10.153536	9.993999	10.006001	10.147535	9.852465	45	35		
26	30	9.846496	10.153504	9.994062	10.005938	10.147566	9.852434	30	34		
27	45	9.846528	10.153472	9.994125	10.005875	10.147598	9.852402	15	33		
28	37	9.846560	10.153440	9.994189	10.005811	10.147629	9.852371	23	32		
29	15	9.846592	10.153408	9.994252	10.005748	10.147660	9.852340	45	31		
30	30	9.846624	10.153376	9.994315	10.005685	10.147691	9.852309	30	30		
31	45	9.846656	10.153344	9.994378	10.005622	10.147722	9.852278	15	29		
32	38	9.846688	10.153312	9.994441	10.005559	10.147753	9.852247	22	28		
33	15	9.846720	10.153280	9.994504	10.005496	10.147785	9.852215	45	27		
34	30	9.846752	10.153248	9.994568	10.005432	10.147816	9.852184	30	26		
35	45	9.846784	10.153216	9.994631	10.005369	10.147847	9.852153	15	25		
36	39	9.846816	10.153184	9.994694	10.005306	10.147878	9.852122	21	24		
37	15	9.846848	10.153152	9.994757	10.005243	10.147909	9.852091	45	23		
38	30	9.846880	10.153120	9.994820	10.005180	10.147941	9.852059	30	22		
39	45	9.846912	10.153088	9.994883	10.005117	10.147972	9.852028	15	21		
40	40	9.846944	10.153056	9.994947	10.005053	10.148003	9.851997	20	20		
41	15	9.846976	10.153024	9.995010	10.004990	10.148034	9.851966	45	19		
42	30	9.847007	10.152993	9.995073	10.004927	10.148066	9.851934	30	18		
43	45	9.847039	10.152961	9.995136	10.004864	10.148097	9.851903	15	17		
44	41	9.847071	10.152929	9.995199	10.004801	10.148128	9.851872	19	16		
45	15	9.847103	10.152897	9.995262	10.004738	10.148159	9.851841	45	15		
46	30	9.847135	10.152865	9.995326	10.004674	10.148190	9.851810	30	14		
47	45	9.847167	10.152833	9.995389	10.004611	10.148222	9.851778	15	13		
48	42	9.847199	10.152801	9.995452	10.004548	10.148253	9.851747	18	12		
49	15	9.847231	10.152769	9.995515	10.004485	10.148284	9.851716	45	11		
50	30	9.847263	10.152737	9.995578	10.004422	10.148315	9.851685	30	10		
51	45	9.847295	10.152705	9.995641	10.004359	10.148347	9.851653	15	9		
52	43	9.847327	10.152673	9.995705	10.004295	10.148378	9.851622	17	8		
53	15	9.847359	10.152641	9.995768	10.004232	10.148409	9.851591	45	7		
54	30	9.847390	10.152610	9.995831	10.004169	10.148441	9.851559	30	6		
55	45	9.847422	10.152578	9.995894	10.004106	10.148472	9.851528	15	5		
56	44	9.847454	10.152546	9.995957	10.004043	10.148503	9.851497	16	4		
57	15	9.847486	10.152514	9.996020	10.003980	10.148534	9.851466	45	3		
58	30	9.847518	10.152482	9.996084	10.003916	10.148566	9.851434	30	2		
59	45	9.847550	10.152450	9.996147	10.003853	10.148597	9.851403	15	1		
60	45	9.847582	10.152418	9.996210	10.003790	10.148628	9.851372	15	0		
sec.	"	cosine.	secant.	cotangent.	tangent.	cosecant.	sine.	"	sec.		
3 ^h 1 ^m .			LOG. SINES, &c.				45 deg.				

2 ^h 59 ^m		LOG. SINES, &c. (t.)						44 deg.	
sec.	"	sine.	coscant.	tangent.	cotangent.	secant.	cosine.	"	sec.
0	45	9.847582	10.152418	9.996210	10.003790	10.148628	9.851372	15	60
1	15	9.847614	10.152386	9.996273	10.003727	10.148660	9.851340	45	59
2	30	9.847645	10.152355	9.996336	10.003664	10.148691	9.851309	30	58
3	45	9.847677	10.152323	9.996399	10.003601	10.148722	9.851278	15	57
4	46	9.847709	10.152291	9.996463	10.003537	10.148754	9.851246	14	56
5	15	9.847741	10.152259	9.996526	10.003474	10.148785	9.851215	45	55
6	30	9.847773	10.152227	9.996589	10.003411	10.148816	9.851184	30	54
7	45	9.847805	10.152195	9.996652	10.003348	10.148848	9.851152	15	53
8	47	9.847836	10.152164	9.996715	10.003285	10.148879	9.851121	13	52
9	15	9.847868	10.152132	9.996778	10.003222	10.148910	9.851090	45	51
10	30	9.847900	10.152100	9.996842	10.003158	10.148942	9.851058	30	50
11	45	9.847932	10.152068	9.996905	10.003095	10.148973	9.851027	15	49
12	48	9.847964	10.152036	9.996968	10.003032	10.149004	9.850996	12	48
13	15	9.847995	10.152005	9.997031	10.002969	10.149036	9.850964	45	47
14	30	9.848027	10.151973	9.997094	10.002906	10.149067	9.850933	30	46
15	45	9.848059	10.151941	9.997157	10.002843	10.149098	9.850902	15	45
16	49	9.848091	10.151909	9.997221	10.002779	10.149130	9.850870	11	44
17	15	9.848123	10.151877	9.997284	10.002716	10.149161	9.850839	45	43
18	30	9.848154	10.151846	9.997347	10.002653	10.149193	9.850807	30	42
19	45	9.848186	10.151814	9.997410	10.002590	10.149224	9.850776	15	41
20	50	9.848218	10.151782	9.997473	10.002527	10.149255	9.850745	10	40
21	15	9.848250	10.151750	9.997536	10.002464	10.149287	9.850713	45	39
22	30	9.848281	10.151719	9.997600	10.002400	10.149318	9.850682	30	38
23	45	9.848313	10.151687	9.997663	10.002337	10.149350	9.850650	15	37
24	51	9.848345	10.151655	9.997726	10.002274	10.149381	9.850619	9	36
25	15	9.848377	10.151623	9.997789	10.002211	10.149412	9.850588	45	35
26	30	9.848408	10.151592	9.997852	10.002148	10.149444	9.850556	30	34
27	45	9.848440	10.151560	9.997915	10.002085	10.149475	9.850525	15	33
28	52	9.848472	10.151528	9.997979	10.002021	10.149507	9.850493	8	32
29	15	9.848504	10.151496	9.998042	10.001958	10.149538	9.850462	45	31
30	30	9.848535	10.151465	9.998105	10.001895	10.149570	9.850430	30	30
31	45	9.848567	10.151433	9.998168	10.001832	10.149601	9.850399	15	29
32	53	9.848599	10.151401	9.998231	10.001769	10.149633	9.850367	7	28
33	15	9.848631	10.151369	9.998294	10.001706	10.149664	9.850336	45	27
34	30	9.848662	10.151338	9.998358	10.001642	10.149695	9.850305	30	26
35	45	9.848694	10.151306	9.998421	10.001579	10.149727	9.850273	15	25
36	54	9.848726	10.151274	9.998484	10.001516	10.149758	9.850242	6	24
37	15	9.848757	10.151243	9.998547	10.001453	10.149790	9.850210	45	23
38	30	9.848789	10.151211	9.998610	10.001390	10.149821	9.850179	30	22
39	45	9.848821	10.151179	9.998673	10.001327	10.149853	9.850147	15	21
40	55	9.848852	10.151148	9.998737	10.001263	10.149884	9.850116	5	20
41	15	9.848884	10.151116	9.998800	10.001200	10.149916	9.850084	45	19
42	30	9.848916	10.151084	9.998863	10.001137	10.149947	9.850053	30	18
43	45	9.848947	10.151053	9.998926	10.001074	10.149979	9.850021	15	17
44	56	9.848979	10.151021	9.998989	10.001011	10.150010	9.849990	4	16
45	15	9.849011	10.150989	9.999052	10.000948	10.150042	9.849958	45	15
46	30	9.849042	10.150958	9.999116	10.000884	10.150073	9.849927	30	14
47	45	9.849074	10.150926	9.999179	10.000821	10.150105	9.849895	15	13
48	57	9.849106	10.150894	9.999242	10.000758	10.150136	9.849864	3	12
49	15	9.849137	10.150863	9.999305	10.000695	10.150168	9.849832	45	11
50	30	9.849169	10.150831	9.999368	10.000632	10.150199	9.849801	30	10
51	45	9.849201	10.150799	9.999431	10.000569	10.150231	9.849769	15	9
52	58	9.849232	10.150768	9.999495	10.000505	10.150263	9.849737	2	8
53	15	9.849264	10.150736	9.999558	10.000442	10.150294	9.849706	45	7
54	30	9.849295	10.150705	9.999621	10.000379	10.150326	9.849674	30	6
55	45	9.849327	10.150673	9.999684	10.000316	10.150357	9.849643	15	5
56	59	9.849359	10.150641	9.999747	10.000253	10.150389	9.849611	1	4
57	15	9.849390	10.150610	9.999810	10.000190	10.150420	9.849580	45	3
58	30	9.849422	10.150578	9.999874	10.000126	10.150452	9.849548	30	2
59	45	9.849453	10.150547	9.999937	10.000063	10.150483	9.849517	15	1
60	60	9.849485	10.150515	10.000000	10.000000	10.150515	9.849485	0	0
sec.	"	cosine.	secant.	cotangent.	tangent.	coscant.	sine.	"	sec.
3 ^h 0 ^m		LOG. SINES, &c.						45 deg.	

PROPORTIONAL PARTS.

Consider as many right hand figures decimal fractions as case requires, and the same number of decimal fractions in N^r. taken out as in N^r. entered with.

15	14	13	*12*	11	10	9	8	7	6	5	4	3	2	1	1/4	*12
60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	1	for min.
1250	1167	1083	1000	917	833	750	667	583	500	417	333	250	167	83	21	15000
1300	1213	1127	1040	953	867	780	693	607	520	433	347	260	173	87	22	15600
1350	1260	1170	1080	990	900	810	720	630	540	450	360	270	180	90	22	16200
1400	1307	1213	1120	1027	933	840	747	653	560	467	373	280	187	93	23	16800
1450	1353	1257	1160	1063	967	870	773	677	580	483	387	290	193	97	24	17400
1500	1400	1300	1200	1100	1000	900	800	700	600	500	400	300	200	100	25	18000
1550	1447	1343	1240	1137	1033	930	827	723	620	517	413	310	207	103	26	18600
1600	1493	1387	1280	1173	1067	960	853	747	640	533	427	320	213	107	27	19200
1650	1540	1430	1320	1210	1100	990	880	770	660	550	440	330	210	107	27	19800
1700	1587	1473	1360	1247	1133	1020	907	793	680	567	453	340	227	113	28	20400
1750	1633	1517	1400	1283	1167	1050	933	817	700	583	467	350	233	117	29	21000
1800	1680	1560	1440	1320	1200	1080	960	840	720	600	480	360	240	120	30	21600
1850	1727	1603	1480	1357	1233	1110	987	863	740	617	493	370	247	123	31	22200
1900	1773	1647	1520	1393	1267	1140	1013	887	760	633	507	380	253	127	32	22800
1950	1820	1690	1560	1430	1300	1170	1040	910	780	650	520	390	260	130	32	23400
2000	1867	1733	1600	1467	1333	1200	1067	933	800	667	533	400	267	133	33	24000
2050	1913	1777	1640	1503	1367	1230	1093	957	820	683	547	410	273	137	34	24600
2100	1960	1820	1680	1540	1400	1260	1120	980	840	700	560	420	280	140	35	25200
2150	2007	1863	1720	1577	1433	1290	1147	1003	860	717	573	430	287	143	36	25800
2200	2053	1907	1760	1613	1467	1320	1173	1027	880	733	587	440	293	147	37	26400
2250	2100	1950	1800	1650	1500	1350	1200	1050	900	750	600	450	300	150	37	27000
2300	2147	1993	1840	1687	1533	1380	1227	1073	920	767	613	460	307	153	38	27600
2350	2193	2037	1880	1723	1567	1410	1253	1097	940	783	627	470	313	157	39	28200
2400	2240	2080	1920	1760	1600	1440	1280	1120	960	800	640	480	320	160	40	28800
2450	2287	2123	1960	1797	1633	1470	1307	1143	980	817	653	490	327	163	41	29400
2500	2333	2167	2000	1833	1667	1500	1333	1167	1000	833	667	500	333	167	42	30000
2550	2380	2210	2040	1870	1700	1530	1360	1190	1020	850	680	510	340	170	42	30600
2600	2427	2253	2080	1907	1733	1560	1387	1213	1040	867	693	520	347	173	43	31200
2650	2473	2297	2120	1943	1767	1590	1413	1237	1060	883	707	530	353	177	44	31800
2700	2520	2340	2160	1980	1800	1620	1440	1260	1080	900	720	540	360	180	45	32400
2750	2567	2383	2200	2017	1833	1650	1467	1283	1100	917	733	550	367	183	46	33000
2800	2613	2427	2240	2053	1867	1680	1493	1307	1120	933	747	560	373	187	47	33600
2850	2660	2470	2280	2090	1900	1710	1520	1330	1140	950	760	570	380	190	47	34200
2900	2707	2513	2320	2127	1933	1740	1547	1353	1160	967	773	580	387	193	48	34800
2950	2753	2557	2360	2163	1967	1770	1573	1377	1180	983	787	590	393	197	49	35400
3000	2800	2600	2400	2200	2000	1800	1600	1400	1200	1000	800	600	400	200	50	36000
3050	2847	2643	2440	2237	2033	1830	1627	1423	1220	1017	813	610	407	203	51	36600
3100	2893	2687	2480	2273	2067	1860	1653	1447	1240	1033	827	620	413	207	52	37200
3150	2940	2730	2520	2310	2100	1890	1680	1470	1260	1050	840	630	420	210	52	37800
3200	2987	2773	2560	2347	2133	1920	1707	1493	1280	1067	853	640	427	213	53	38400
3250	3033	2817	2600	2383	2167	1950	1733	1517	1300	1083	867	650	433	217	54	39000
3300	3080	2860	2640	2420	2200	1980	1760	1540	1320	1100	880	660	440	220	55	39600
3350	3127	2903	2680	2457	2233	2010	1787	1563	1340	1117	893	670	447	223	56	40200
3400	3173	2947	2720	2493	2267	2040	1813	1587	1360	1133	907	680	453	227	57	40800
3450	3220	2990	2760	2530	2300	2070	1840	1610	1380	1150	920	690	460	230	57	41400
3500	3267	3033	2800	2567	2333	2100	1867	1633	1400	1167	933	700	467	233	58	42000
3550	3313	3077	3000	2603	2367	2130	1893	1657	1420	1183	947	710	473	237	59	42600
3600	3360	3120	3040	2640	2400	2160	1920	1680	1440	1200	960	720	480	240	60	43200
3650	3407	3163	3080	2677	2433	2190	1947	1703	1460	1217	973	730	487	243	61	43800
3700	3453	3207	3120	2713	2467	2220	1973	1727	1480	1233	987	740	493	247	62	44400
3750	3500	3250	3160	2750	2500	2250	2000	1750	1500	1250	1000	750	500	250	62	45000
3800	3547	3293	3200	2787	2533	2280	2027	1773	1520	1267	1013	760	507	253	63	45600
3850	3593	3337	3240	2823	2567	2310	2053	1797	1540	1283	1027	770	513	257	64	46200
3900	3640	3380	3280	2860	2600	2340	2080	1813	1560	1300	1040	780	520	260	65	46800
3950	3687	3423	3320	2897	2633	2370	2107	1837	1580	1317	1053	790	527	263	66	47400
4000	3733	3467	3360	2933	2667	2400	2133	1860	1600	1333	1067	800	533	267	67	48000
4050	3780	3510	3400	2970	2700	2430	2160	1883	1620	1350	1080	810	540	270	68	48600
4100	3827	3553	3440	3007	2733	2460	2187	1903	1640	1367	1093	820	547	273	69	49200
4150	3873	3597	3480	3043	2767	2490	2213	1927	1660	1383	1107	830	553	277	70	49800
4200	3920	3640	3520	3080	2800	2520	2240	1947	1680	1400	1120	840	560	280	71	50400
4250	3967	3683	3560	3117	2833	2550	2267	1967	1700	1417	1133	850	567	283	72	51000
4300	4013	3727	3600	3153	2867	2580	2293	1987	1720	1433	1147	860	573	287	73	51600
4350	4060	3770	3640	3190	2900	2610	2320	2010	1740	1450	1160	870	580	290	74	52200
4400	4107	3813	3680	3227	2933	2640	2347	2033	1760	1467	1173	880	587	293	75	52800
4450	4153	3857	3720	3263	2967	2670	2373	2057	1780	1483	1187	890	593	297	76	53400
4500	4200	3900	3760	3300	3000	2700	2400	2080	1800	1500	1200	900	600	300	77	54000
4550	4247	3943	3800	3337	3033	2730	2427	2103	1820	1517	1213	910	607	303	78	54600
4600	4293	3987	3840	3373	3067	2760	2453	2127	1840	1533	1227	920	613	307	79	55200
4650	4340	4030	3880	3410	3100	2790	2480	2150	1860	1550	1240	930	620	310	80	55800
4700	4387	4073	3920	3447	3133	2820	2507	2173	1880	1567	1253	940	627	313	81	56400
4750	4433	4117	3960	3483	3167	2850	2533	2197	1900	1583	1267	950	633	317	82	57000
4800	4480	4160	4000	3520	3200	2880	2560	2220	1920	1600	1280	960	640	320	83	57600
4850	4527	4203	4040	3557	3233	2910	2587	2243	1940	1617	1293	970	647	323	84	58200
4900	4573	4247	4080	3593	3267	2940	2613	2267	1960	1633	1307	980	653	327	85	58800
4950	4620	4290	4120	3630	3300	2970	2640	2290	1980	1650	1320	990	660	330	86	59400
5000	4667	4333	4160	3667	3333	3000	2667	2313	2000	1667	1333	1000	667	333	87	60000
5050	4713	4377	4200	3703	3367	3030	2693	2337	2020	1683	1347	1010	673	337	88	60600
5100	4760	4420	4240	3740	3400	3060	2720	2360	2040	1700	1360	1020	680	340	89	61200
5150	4807	4463	4280	3777	3433	3090	2747	2383	2060	1717	1373	1030	687	343	90</	

		0 deg.				1 deg.				2 deg.					
SEC.		0m	1m	2m	3m	4m	5m	6m	7m	8m	9m	SEC.			
	0	0.000000	4.677574	5.279632	5.631811	5.881684	6.075498	6.233852	6.367737	6.483711	6.586004	60	0		
	15	1.121274	691931	286840	636623	885295	078388	236262	369802	485518	587611	59	15		
	30	1.723332	706055	293989	641409	888892	081269	238664	371863	487322	589215	58	30		
	45	2.075516	719952	301079	646168	892473	084140	241060	373919	489122	590815	57	45		
	0	2.325392	4.733631	5.308113	5.650901	5.896041	6.087002	6.243450	6.375970	6.490918	6.592413	56	0		
	15	519212	747098	315089	655609	899593	089854	245832	378016	492711	594008	55	15		
	30	677575	760359	322010	660292	903131	092697	248209	380057	494500	595600	54	30		
	45	811470	773421	328876	664949	906654	095531	250579	382093	496285	597190	53	45		
	0	2.927452	4.786289	5.335689	5.669581	5.910164	6.098356	6.252942	6.384125	6.498066	6.598776	52	0		
	15	3.029759	798969	342448	671189	913659	101171	255299	386152	499844	600359	51	15		
	30	121272	811467	349156	678773	917140	103977	257650	388174	501618	601940	50	30		
	45	204057	823788	355811	683332	920608	106774	259994	390191	503389	603517	49	45		
	0	3.279635	4.835936	5.362417	5.687868	5.924061	6.109563	6.262332	6.392204	6.505156	6.605092	48	0		
	15	349159	847917	368972	692380	927501	112342	264663	394212	506920	606664	47	15		
	30	413528	859735	375478	696869	930927	115113	266989	396216	508679	608233	46	30		
	45	473454	871393	381936	701334	934340	117874	269308	398215	510436	609799	45	45		
	0	3.529512	4.882898	5.388347	5.705777	5.937740	6.120627	6.271621	6.400209	6.512189	6.611363	44	0		
	15	582170	894252	394710	710197	941126	123371	273928	402198	513938	612923	43	15		
	30	638187	905460	401027	714595	944499	126107	276229	404184	515683	614481	42	30		
	45	678780	916525	407298	718971	947859	128834	278523	406164	517426	616036	41	45		
	0	3.723332	4.927451	5.413525	5.723325	5.951206	6.131553	6.280812	6.408141	6.519164	6.617588	40	0		
	15	765711	938241	419707	727657	954540	134263	283094	410112	520900	619138	39	15		
	30	806118	948899	425845	731967	957862	136964	285371	412079	522631	620684	38	30		
	45	844728	959427	431940	736256	961170	139657	287642	414042	524360	622228	37	45		
	0	3.881695	4.969829	5.437993	5.740525	5.964467	6.142342	6.289906	6.416000	6.526085	6.623770	36	0		
	15	917152	980108	444004	744772	967750	145019	292165	417954	527806	625308	35	15		
	30	951219	990268	449974	748999	971022	147687	294418	419904	529524	626844	34	30		
	45	984000	5.000309	455903	753205	974281	150347	296665	421849	531239	628377	33	45		
	0	4.015588	5.010236	5.461791	5.757391	5.977528	6.152999	6.298907	6.423790	6.532950	6.629907	32	0		
	15	046068	020050	467640	761556	980763	155643	301142	425726	534658	631435	31	15		
	30	075515	029756	473450	765702	983986	158279	303372	427659	536363	632960	30	30		
	45	103996	039353	479222	769829	987197	160907	305996	429586	538064	634482	29	45		
	0	4.131572	5.048846	5.484955	5.773935	5.990396	6.163527	6.307815	6.431510	6.539762	6.636002	28	0		
	15	158300	058236	490650	778023	993583	166139	310028	433429	541457	637519	27	15		
	30	184230	067526	496309	782091	996759	168744	312235	435345	543148	639033	26	30		
	45	209408	076717	501931	786140	999923	171340	314437	437255	544836	640545	25	45		
	0	4.233877	5.085813	5.507517	5.790171	6.003076	6.173929	6.316633	6.439162	6.546521	6.642054	24	0		
	15	257675	094814	513067	794183	006217	176510	318823	441065	548202	643560	23	15		
	30	280839	103723	515852	798176	009347	179084	321008	442963	549880	645064	22	30		
	45	303401	112540	524062	802151	012466	181650	323187	444857	551555	646565	21	45		
	0	4.325392	5.121270	5.529507	5.806108	6.015573	6.184208	6.325362	6.446747	6.553227	6.648064	20	0		
	15	346840	129913	534919	810047	018670	186759	327530	448633	554896	649560	19	15		
	30	367771	138471	540297	813969	021755	189302	329693	450515	556561	651053	18	30		
	45	388209	146944	545642	817872	024830	191838	331851	452393	558223	652544	17	45		
	0	4.408177	5.155337	5.550955	5.821759	6.027894	6.194366	6.334004	6.454267	6.559882	6.654033	16	0		
	15	427697	163648	556235	825628	030946	196888	336151	456137	561538	655518	15	15		
	30	446788	171882	561483	829479	033989	199402	338293	458003	563191	657002	14	30		
	45	465467	180037	566700	833314	037020	201908	340429	459864	564840	658482	13	45		
	0	4.483754	5.188118	5.571885	5.837132	6.040041	6.204408	6.342561	6.461722	6.566487	6.659961	12	0		
	15	501664	196123	577040	840933	043052	206900	344687	463576	568130	661436	11	15		
	30	519212	204053	582165	844718	046052	209385	346808	465426	569770	662910	10	30		
	45	536412	211916	5887259	848486	049042	211863	348923	467272	571407	664380	9	45		
	0	4.553278	5.219706	5.592323	5.852238	6.052022	6.214334	6.351034	6.469114	6.573041	6.665849	8	0		
	15	569823	227427	597359	855974	054991	216798	353140	470952	574762	667314	7	15		
	30	586059	235079	602365	859693	057950	219255	355240	472786	576300	668778	6	30		
	45	601997	242665	607342	863397	060900	221705	357335	474616	577925	670238	5	45		
	0	4.617648	5.250186	5.612292	5.867086	6.063839	6.224148	6.359426	6.476443	6.579547	6.671697	4	0		
	15	633021	257641	617213	870758	066768	226584	361511	478265	581166	673153	3	15		
	30	648128	265034	622106	874115	069688	229014	363591	480084	582781	674606	2	30		
	45	662978	272363	626972	878057	072597	231436	365667	481899	584394	676057	1	45		
	0	4.677574	5.279632	5.631811	5.881684	6.075498	6.233852	6.367737	6.483711	6.586004	6.677506	0	0		
SEC.		59m	58m	57m	56m	55m	54m	53m	52m	51m	50m	SEC.			

SEC.	10 ^m		11 ^m		12 ^m		13 ^m		14 ^m		15 ^m		16 ^m		17 ^m		18 ^m		19 ^m		SEC.
	2 deg.		3 deg.		4 deg.		5 deg.		6 deg.		7 deg.		8 deg.		9 deg.		10 deg.		11 deg.		
	0'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'
0	0	6.677506	6.760277	6.835838	6.905345	6.969696	7.029602	7.085638	7.138273	7.187897	7.234833	7.279594	7.324833	7.370594	7.416833	7.463594	7.510833	7.558594	7.606833	7.655594	60
1	15	678952	761592	837043	906458	970729	030566	086542	139124	188700	235594	283558	331157	379157	427457	475757	524057	572357	620657	668957	59
2	30	680396	762904	838247	907569	971761	031530	087445	139974	189503	236355	284315	331915	379915	428115	476315	524515	572715	620915	669115	58
3	45	681837	764215	839449	908678	972791	032492	088347	140823	190305	237115	284315	331915	379915	428115	476315	524515	572715	620915	669115	57
4	0	6.683276	6.765524	6.840649	6.909787	6.973821	7.033453	7.089248	7.141671	7.191106	7.237874	7.281633	7.324833	7.367433	7.409433	7.450833	7.491633	7.531833	7.571433	7.610433	56
5	15	684713	766831	841848	910894	974849	034413	090149	142519	191906	238632	283355	327933	372457	416933	461357	505733	549957	594033	637957	55
6	30	686147	768136	843045	911999	975876	035372	091048	143365	192706	239390	284033	328533	372933	417333	461733	506133	550533	594933	639333	54
7	45	687579	769439	844240	913103	976902	036329	091946	144211	193505	240147	284733	329233	373733	418233	462733	507233	551733	596233	640733	53
8	0	6.689009	6.770740	6.845434	6.912406	6.977926	7.037286	7.092844	7.145056	7.194303	7.240904	7.285633	7.329333	7.372033	7.414733	7.456433	7.497133	7.537833	7.578533	7.619233	52
9	15	690436	772039	846626	915307	978950	038242	093740	145900	195101	241660	286333	330933	375533	420133	464733	509333	553933	598533	643133	51
10	30	691861	773336	847816	916407	979972	039197	094636	146744	195898	242415	287033	331633	376233	420833	465433	510033	554633	599233	643833	50
11	45	693283	774631	849005	917505	980993	040150	095530	147586	196694	243169	288233	332833	377433	422033	466633	511233	555833	600433	645033	49
12	0	6.694703	6.775924	6.850192	6.918603	6.982013	7.041103	7.096424	7.148428	7.197489	7.243923	7.288633	7.332333	7.375033	7.417733	7.460433	7.503133	7.545833	7.588533	7.631233	48
13	15	696121	777216	851377	919698	983031	042054	097317	149269	198284	244766	289433	334033	378633	423233	467833	512433	557033	601633	646233	47
14	30	697537	778505	852561	920793	984048	043005	098209	150109	199078	245429	290033	335233	379833	424433	469033	513633	558233	602833	647433	46
15	45	698950	779793	853743	921886	985064	043954	099100	150948	199871	246181	291033	336233	380833	425633	470233	514833	559433	604033	648633	45
16	0	6.700361	6.781078	6.854924	6.922977	6.986080	7.044903	7.099990	7.151786	7.200663	7.246932	7.291633	7.335333	7.378033	7.420733	7.463433	7.506133	7.548833	7.591533	7.634233	44
17	15	701770	782362	856103	924067	987093	045850	100740	152624	201455	246833	291533	335233	379833	424433	469033	513633	558233	602833	647433	43
18	30	703176	783644	857281	925156	988106	046796	101767	153461	202246	248433	292533	336233	380833	425633	470233	514833	559433	604033	648633	42
19	45	704580	784924	858457	926244	989117	047742	102654	154297	203036	249182	293233	337433	382033	426833	471433	516033	560633	605233	649833	41
20	0	6.705982	6.786202	6.859631	6.927330	6.990128	7.048636	7.103541	7.155132	7.203826	7.249931	7.294633	7.338333	7.381033	7.423733	7.466433	7.509133	7.551833	7.594533	7.637233	40
21	15	707382	787478	860804	928414	991137	049629	104426	156966	204615	250633	294733	338433	383033	427633	472233	516833	561433	606033	650633	39
22	30	708779	788752	861975	929498	992145	050571	105311	156800	205403	251426	295533	340133	384733	429333	473933	518533	563133	607733	652333	38
23	45	710174	790024	863144	930580	993151	051513	106194	157633	206190	252173	296233	340833	385433	430033	474633	519233	563833	608433	653033	37
24	0	6.711567	6.791295	6.864312	6.931661	6.994157	7.052453	7.107077	7.158465	7.206977	7.252936	7.297633	7.341333	7.385033	7.428733	7.472433	7.516133	7.559833	7.603533	7.647233	36
25	15	712957	792564	865478	932740	995161	053392	107959	159296	207763	253664	297733	342333	386933	431533	476133	520733	565333	610033	654633	35
26	30	714346	793830	866643	933818	996165	054330	108840	160126	208548	254409	298433	343633	388233	432833	477433	522033	566633	611333	655933	34
27	45	715732	795095	867807	934895	997167	055267	109720	160956	209333	255133	299233	344833	389433	434033	478633	523233	567833	612633	657133	33
28	0	6.717116	6.796359	6.868968	6.935970	6.998168	7.056203	7.110599	7.161785	7.210117	7.255897	7.299633	7.343333	7.387033	7.430733	7.474433	7.518133	7.561833	7.605533	7.649233	32
29	15	718498	797620	870128	937044	999167	057138	111478	162613	210900	256640	300333	345033	389633	434233	478833	523433	568033	612633	657233	31
30	30	719877	798879	871287	938117	7.000166	058073	112355	163440	211682	257382	301033	346333	390933	435533	480133	524733	569333	613933	658533	30
31	45	721255	800137	872444	939188	001163	059006	113232	164266	212464	258124	302033	347633	391533	436833	481433	526033	570633	615233	659833	29
32	0	6.722630	6.801393	6.873600	6.940258	7.002160	7.059938	7.114107	7.165092	7.213245	7.258865	7.302633	7.346333	7.390033	7.433733	7.477433	7.521133	7.564833	7.608533	7.652233	28
33	15	724003	802647	874754	941327	003155	060869	114982	165917	214025	259605	303333	348933	392833	437933	482533	527133	571733	616333	660933	27
34	30	725374	803899	875906	942394	004149	061799	115856	166741	214805	260345	304033	350133	394033	439133	483733	528333	572933	617533	662133	26
35	45	726743	805149	877057	943460	005142	062728	116729	167564	215584	261084	305033	351133	395033	440133	484733	529333	573933	618533	663733	25
36	0	6.728109	6.806398	6.878206	6.944525	7.006134	7.063656	7.117601	7.168387	7.216362	7.261822	7.306333	7.350833	7.395333	7.439833	7.484333	7.528833	7.573333	7.617833	7.662333	24
37	15	729473	807645	879354	945589	007124	064583	118472	169208	217140	262630	306133	352233	396133	441233	485733	530333	574933	619533	664133	23
38	30	730836	808890	880501	946651	008114	065510	119343	170029	217917	263297	307033	353133	397033	442333	486833	531433	575933	620533	665133	22
39	45	732196	810133	881645	947712	009102	066435	120212	170849	218693	264034	308033	354233	398133	443433	487933	532533	576933	621633	666233	21
40	0	6.733554	6.811375	6.882789	6.948771	7.010089	7.067359	7.121081	7.171669	7.219463	7.264770	7.309033	7.353633	7.398233	7.442833	7.487433	7.532033	7.576633	7.621233	7.665833	20
41	15	734910	812614	883931	949829	011075	068282	121949	172488	220243	265504	309633	355733	400033	444633	489233	533833	578433	623033	667633	19
42	30	736263	813852	885071	950887	012061	069204	122816	173305	221017	266240	310733	356833	401133	445733	490333	534933	579533	624133	668733	18
43	45	737615	815088	886210	951942	013044	070125	123681	174122	221790	266974	311833	357933	402233	446833	491433					

		20 ^m	21 ^m	22 ^m	23 ^m	24 ^m	25 ^m	26 ^m	27 ^m	28 ^m	29 ^m		
		5 deg.				6 deg.				7 deg.			
°	′	0′	15′	30′	45′	0′	15′	30′	45′	0′	15′	°	′
		0°	15°	30°	45°	0°	15°	30°	45°	0°	15°		
0	0	7.279359	7.321709	7.362087	7.400666	7.437600	7.473024	7.507056	7.539800	7.571351	7.601791	60	0
1	15	280082	322398	362744	401294	438203	473602	507612	540335	571867	602290	59	15
2	30	280805	323086	363401	401923	438805	474180	508167	540870	572383	602788	58	30
3	45	281526	323774	364057	402550	439406	474758	508723	541405	572898	603285	57	45
4	0	282248	7.324461	7.364713	7.403178	7.440008	7.475335	7.509278	7.541939	7.573414	7.603783	56	0
5	15	282968	325147	365368	403805	440608	475912	509832	542474	573929	604240	55	15
6	30	283688	325833	366023	404431	441209	476488	510386	543007	574443	604777	54	30
7	45	284408	326518	366677	405057	441809	477064	510940	543541	574958	605274	53	45
8	0	7.285127	7.327203	7.367331	7.405682	7.442408	7.477640	7.511494	7.544074	7.575472	7.605770	52	0
9	15	285845	327887	367984	406307	443007	478215	512047	544606	575985	606266	51	15
10	30	286563	328571	368637	406932	443606	478790	512600	545139	576499	606762	50	30
11	45	287280	329254	369289	407556	444204	479364	513152	545671	577012	607258	49	45
12	0	7.287996	7.329937	7.369941	7.408180	7.444802	7.479938	7.513704	7.546203	7.577525	7.607753	48	0
13	15	288712	330619	370592	408803	445399	480512	514246	546734	578037	608248	47	15
14	30	289428	331300	371243	409426	445996	481085	514807	547265	578550	608743	46	30
15	45	290142	331981	371894	410048	446593	481658	515358	547796	579062	609237	45	45
16	0	7.290856	7.332662	7.372544	7.410670	7.447189	7.482231	7.515909	7.548327	7.579573	7.609731	44	0
17	15	291570	333342	373193	411291	447785	482803	516460	548857	580085	610225	43	15
18	30	292283	334021	373842	411913	448380	483375	517010	549386	580596	610718	42	30
19	45	292995	334700	374490	412533	448975	483946	517559	549916	581106	611212	41	45
20	0	7.293707	7.335379	7.375138	7.413153	7.449570	7.484517	7.518109	7.550445	7.581617	7.611705	40	0
21	15	294418	336056	375786	413773	450164	485088	518658	550974	582127	612197	39	15
22	30	295129	336734	376433	414392	450758	485658	519206	551502	582637	612690	38	30
23	45	295839	337410	377079	415011	451351	486228	519754	552031	583146	613182	37	45
24	0	7.296548	7.338087	7.377725	7.415629	7.451944	7.486798	7.520302	7.552559	7.583656	7.613674	36	0
25	15	297257	338762	378371	416247	452537	487367	520850	553086	584164	614165	35	15
26	30	297965	339438	379016	416865	453129	487936	521397	553613	584673	614657	34	30
27	45	298673	340112	379660	417481	453721	488504	521944	554140	585181	615148	33	45
28	0	7.299380	7.340786	7.380304	7.418098	7.454312	7.489072	7.522491	7.554667	7.585690	7.615638	32	0
29	15	300087	341460	380948	418714	454903	489640	523037	555193	586197	616129	31	15
30	30	300793	342133	381591	419330	455493	490207	523583	555719	586705	616619	30	30
31	45	301498	342806	382234	419945	456083	490774	524128	556245	587212	617109	29	45
32	0	7.302203	7.343478	7.382876	7.420560	7.456673	7.491341	7.524673	7.556770	7.587719	7.617599	28	0
33	15	302907	344149	383517	421174	457262	491907	525218	557295	588225	618088	27	15
34	30	303611	344820	384159	421788	457851	492473	525763	557820	588732	618577	26	30
35	45	304314	345491	384799	422402	458440	493038	526307	558344	589237	619066	25	45
36	0	7.305017	7.346161	7.385440	7.423015	7.459028	7.493603	7.526850	7.558868	7.589743	7.619554	24	0
37	15	305719	346830	386079	423628	459616	494168	527394	559392	590248	620043	23	15
38	30	306420	347499	386719	424240	460203	494732	527937	559915	590754	620531	22	30
39	45	307121	348168	387358	424852	460790	495296	528480	560438	591258	621018	21	45
40	0	7.307821	7.348833	7.387996	7.425463	7.461376	7.495860	7.529022	7.560961	7.591763	7.621506	20	0
41	15	308521	349503	388634	426074	461962	496423	529564	561483	592267	621993	19	15
42	30	309220	350170	389271	426684	462548	496986	530106	562006	592771	622480	18	30
43	45	309919	350836	389908	427294	463134	497548	530647	562527	593274	622966	17	45
44	0	7.310617	7.351502	7.390545	7.427904	7.463719	7.498118	7.531189	7.563049	7.593778	7.623453	16	0
45	15	311314	352167	391181	428513	464303	498672	531729	563570	594281	623939	15	15
46	30	312011	352832	391816	429122	464887	499234	532270	564091	594784	624425	14	30
47	45	312708	353496	392452	429730	465471	499795	532810	564611	595286	624910	13	45
48	0	7.313403	7.354160	7.393086	7.430338	7.466054	7.500355	7.533349	7.565132	7.595788	7.625395	12	0
49	15	314098	354824	393720	430946	466637	500916	533889	565652	596290	625880	11	15
50	30	314793	355486	394354	431553	467220	501476	534428	566171	596792	626365	10	30
51	45	315487	356149	394987	432160	467802	502035	534966	566691	597293	626849	9	45
52	0	7.316181	7.356810	7.395620	7.432766	7.468384	7.502595	7.535505	7.567210	7.597794	7.627334	8	0
53	15	316874	357472	396252	433372	468965	503153	536043	567728	598294	627817	7	15
54	30	317566	358133	396884	433977	469546	503712	536581	568247	598795	628301	6	30
55	45	318258	358793	397516	434582	470127	504270	537118	568765	599295	628784	5	45
56	0	7.318950	7.359453	7.398147	7.435186	7.470707	7.504828	7.537655	7.569283	7.599795	7.629267	4	0
57	15	319640	360112	398777	435790	471287	505385	538192	569800	600294	629750	3	15
58	30	320331	360771	399407	436394	471866	505943	538728	570317	600794	630233	2	30
59	45	321020	361429	400037	436997	472445	506499	539264	570834	601292	630715	1	45
60	0	7.321709	7.362087	7.400666	7.437600	7.473024	7.507056	7.539800	7.571351	7.601791	7.631197	0	0
		30 ^m	38 ^m	37 ^m	36 ^m	35 ^m	34 ^m	33 ^m	32 ^m	31 ^m	30 ^m		

Sec.	30 ^m		31 ^m	32 ^m		33 ^m	34 ^m	35 ^m	36 ^m		37 ^m	38 ^m	39 ^m	Sec.
	7 deg.			8 deg.					9 deg.					
0	0'	30'	7.631197	15'	7.659636	7.687169	7.713852	7.739736	7.764867	7.789287	7.813035	7.836147	7.858656	60
1	15		631679		660102	687620	714290	740161	765279	789688	813425	836527	859026	59
2	30		632160		660568	688072	714728	740586	765691	790089	813815	836907	859396	58
3	45		632641		661034	688523	715165	741010	766104	790490	814203	837286	859766	57
4	0	31'	7.633122	46'	7.661499	7.688974	7.715602	7.741434	7.766516	7.790890	7.814595	7.837666	7.860136	56
5	15		633603		661964	689424	716039	741858	766928	791291	814985	838045	860505	55
6	30		634083		662429	689875	716476	742282	767340	791691	815374	838424	860875	54
7	45		634564		662894	690325	716912	742706	767751	792091	815763	838803	861244	53
8	0	32'	7.635043	47'	7.663358	7.690775	7.717348	7.743129	7.768163	7.792491	7.816152	7.839182	7.861613	52
9	15		635523		663822	691224	717784	743552	768574	792891	816541	839561	861982	51
10	30		636002		664286	691674	718220	743975	768993	793290	816930	839939	862351	50
11	45		636481		664750	692123	718656	744398	769396	793690	817318	840318	862719	49
12	0	33'	7.636960	48'	7.665213	7.692572	7.719091	7.744821	7.769806	7.794089	7.817707	7.840696	7.863088	48
13	15		637439		665676	693021	719526	745243	770216	794488	818095	841074	863456	47
14	30		637917		666139	693469	719961	745666	770627	794887	818483	841452	863824	46
15	45		638395		666602	693917	720396	746087	771037	795285	818871	841829	864192	45
16	0	34'	7.638873	49'	7.667064	7.694365	7.720831	7.746509	7.771446	7.795844	7.819259	7.842207	7.864560	44
17	15		639350		667526	694813	721265	746931	771856	796082	819646	842584	864928	43
18	30		639827		667988	695261	721699	747352	772265	796480	820034	842961	865295	42
19	45		640304		668450	695708	722133	747773	772675	796878	820421	843338	865663	41
20	0	35'	7.640781	50'	7.668911	7.696155	7.722567	7.748194	7.773084	7.797275	7.820808	7.843715	7.866030	40
21	15		641257		669372	696602	723000	748615	773492	797673	821195	844092	866397	39
22	30		641734		669833	697049	723433	749036	773901	798070	821581	844468	866764	38
23	45		642209		670294	697495	723866	749456	774309	798467	821968	844845	867131	37
24	0	36'	7.642685	51'	7.670755	7.697941	7.724299	7.749876	7.774718	7.798864	7.822354	7.845221	7.867497	36
25	15		643160		671215	698387	724731	750296	775126	799261	822740	845597	867864	35
26	30		643636		671675	698833	725164	750716	775534	799658	823126	845973	868230	34
27	45		644110		672134	699278	725596	751135	775941	800054	823512	846349	868596	33
28	0	37'	7.644585	52'	7.672594	7.699724	7.726028	7.751555	7.776349	7.800450	7.823897	7.846724	7.868962	32
29	15		645059		673053	700169	726459	751974	776756	800846	824283	847099	869328	31
30	30		645533		673512	700614	726891	752393	777163	801242	824668	847475	869694	30
31	45		646007		673971	701058	727322	752811	777570	801638	825053	847850	870059	29
32	0	38'	7.646481	53'	7.674429	7.701527	7.727753	7.753230	7.777977	7.802034	7.825438	7.848225	7.870424	28
33	15		646954		674887	701947	728184	753648	778383	802429	825823	848599	870790	27
34	30		647427		675346	702390	728615	754066	778789	802824	826207	848974	871155	26
35	45		647900		675803	702834	729045	754484	779195	803219	826592	849348	871520	25
36	0	39'	7.648372	54'	7.676261	7.703278	7.729475	7.754902	7.779601	7.803614	7.826976	7.849723	7.871884	24
37	15		648845		676718	703721	729905	755319	780007	804008	827360	850097	872429	23
38	30		649317		677175	704164	730335	755737	780413	804403	827744	850470	872613	22
39	45		649788		677632	704606	730765	756154	780818	804797	828128	850844	872978	21
40	0	40'	7.650260	55'	7.678088	7.705409	7.731194	7.756571	7.781223	7.805191	7.828511	7.851218	7.873342	20
41	15		650731		678545	705491	731623	756987	781628	805585	828895	851591	873706	19
42	30		651202		679001	705933	732052	757404	782033	805979	829278	851964	874070	18
43	45		651673		679457	706375	732481	757820	782437	806372	829661	852338	874433	17
44	0	41'	7.652143	56'	7.679912	7.706817	7.732909	7.758236	7.782842	7.806766	7.830044	7.852711	7.874791	16
45	15		652613		680367	707258	733337	758652	783246	807159	830426	853083	875160	15
46	30		653083		680823	707699	733765	759068	783650	807552	830809	853456	875523	14
47	45		653553		681277	708140	734193	759483	784054	807944	831191	853828	875886	13
48	0	42'	7.654022	57'	7.681732	7.708581	7.734621	7.759899	7.784458	7.808337	7.831574	7.854201	7.876249	12
49	15		654492		682186	709021	735048	760314	784861	808729	831956	854573	876612	11
50	30		654961		682641	709462	735475	760729	785264	809122	832338	854945	876975	10
51	45		655429		683095	709902	735902	761143	785667	809514	832719	855317	877337	9
52	0	43'	7.655898	58'	7.683548	7.710342	7.736329	7.761558	7.786070	7.809906	7.833101	7.855688	7.877699	8
53	15		656366		684002	710781	736756	761972	786473	810297	833482	856060	878061	7
54	30		656834		684455	711221	737182	762386	786875	810689	833863	856431	878423	6
55	45		657301		684908	711660	737608	762800	787278	811080	834244	856802	878785	5
56	0	44'	7.657769	59'	7.685361	7.712099	7.738034	7.763214	7.787680	7.811472	7.834625	7.857173	7.879147	4
57	15		658236		685813	712537	738460	763627	788082	811863	835006	857544	879508	3
58	30		658703		686265	712976	738886	764041	788484	812254	835386	857915	879870	2
59	45		659169		686717	713414	739311	764454	788885	812644	835767	858285	880231	1
60	0	29 ^m	7.659636	28 ^m	7.687169	7.713852	7.739736	7.764867	7.789287	7.813035	7.836147	7.858656	7.880592	0

		40 ^m				41 ^m				42 ^m				43 ^m				44 ^m				45 ^m				46 ^m				47 ^m				48 ^m				49 ^m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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		0'				15'				30'				45'				0'				15'				30'				45'				0'				15'				30'				45'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
0	0	7.880592	7.901984	7.922858	7.943237	7.963146	7.982604	8.001632	8.020248	8.038469	8.056312	8.073857	8.091094	8.107924	8.124348	8.140367	8.156982	8.173193	8.188999	8.204402	8.219402	8.233999	8.248193	8.261984	8.275372	8.288357	8.299939	8.311119	8.321897	8.332274	8.342250	8.351826	8.360999	8.369770	8.378139	8.386106	8.393672	8.400837	8.407601	8.413964	8.419926	8.425887	8.431846	8.437803	8.443758	8.449711	8.455662	8.461611	8.467558	8.473503	8.479446	8.485387	8.491326	8.497263	8.503198	8.509131	8.515062	8.520991	8.526918	8.532843	8.538766	8.544687	8.550606	8.556523	8.562438	8.568351	8.574262	8.580171	8.586078	8.591983	8.597886	8.603787	8.609686	8.615583	8.621478	8.627371	8.633262	8.639151	8.645038	8.650923	8.656806	8.662687	8.668566	8.674443	8.680318	8.686191	8.692062	8.697931	8.703798	8.709663	8.715526	8.721387	8.727246	8.733103	8.738958	8.744811	8.750662	8.756511	8.762358	8.768203	8.774046	8.779887	8.785726	8.791563	8.797398	8.803231	8.809062	8.814891	8.820718	8.826543	8.832366	8.838187	8.844006	8.849823	8.855638	8.861451	8.867262	8.873071	8.878878	8.884683	8.890486	8.896287	8.902086	8.907883	8.913678	8.919471	8.925262	8.931051	8.936838	8.942623	8.948406	8.954187	8.959966	8.965743	8.971518	8.977291	8.983062	8.988831	8.994598	9.000363	9.006126	9.011887	9.017646	9.023403	9.029158	9.034911	9.040662	9.046411	9.052158	9.057903	9.063646	9.069387	9.075126	9.080863	9.086598	9.092331	9.098062	9.103791	9.109518	9.115243	9.120966	9.126687	9.132406	9.138123	9.143838	9.149551	9.155262	9.160971	9.166678	9.172383	9.178086	9.183787	9.189486	9.195183	9.200878	9.206571	9.212262	9.217951	9.223638	9.229323	9.235006	9.240687	9.246366	9.252043	9.257718	9.263391	9.269062	9.274731	9.280398	9.286063	9.291726	9.297387	9.303046	9.308703	9.314358	9.319991	9.325622	9.331251	9.336878	9.342503	9.348126	9.353747	9.359366	9.364983	9.370598	9.376211	9.381822	9.387431	9.393038	9.398643	9.404246	9.409847	9.415446	9.421043	9.426638	9.432231	9.437822	9.443411	9.448998	9.454583	9.460166	9.465747	9.471326	9.476903	9.482478	9.488051	9.493622	9.499191	9.504758	9.510323	9.515886	9.521447	9.527006	9.532563	9.538118	9.543671	9.549222	9.554771	9.560318	9.565863	9.571406	9.576947	9.582486	9.588023	9.593558	9.599091	9.604622	9.610151	9.615678	9.621203	9.626726	9.632247	9.637766	9.643283	9.648798	9.654311	9.659822	9.665331	9.670838	9.676343	9.681846	9.687347	9.692846	9.698343	9.703838	9.709331	9.714822	9.720311	9.725798	9.731283	9.736766	9.742247	9.747726	9.753203	9.758678	9.764151	9.769622	9.775091	9.780558	9.786023	9.791486	9.796947	9.802406	9.807863	9.813318	9.818771	9.824222	9.829671	9.835118	9.840563	9.846006	9.851447	9.856886	9.862323	9.867758	9.873191	9.878622	9.884051	9.889478	9.894903	9.900326	9.905747	9.911166	9.916583	9.921998	9.927411	9.932822	9.938231	9.943638	9.949043	9.954446	9.959847	9.965246	9.970643	9.976038	9.981431	9.986822	9.992211	9.997598	10.002983	10.008366	10.013747	10.019126	10.024503	10.029878	10.035251	10.040622	10.045991	10.051358	10.056723	10.062086	10.067447	10.072806	10.078163	10.083518	10.088871	10.094222	10.099571	10.104918	10.110263	10.115606	10.120947	10.126286	10.131623	10.136958	10.142291	10.147622	10.152951	10.158278	10.163603	10.168926	10.174247	10.179566	10.184883	10.190198	10.195511	10.200822	10.206131	10.211438	10.216743	10.222046	10.227347	10.232646	10.237943	10.243238	10.248531	10.253822	10.259111	10.264398	10.269683	10.274966	10.280247	10.285526	10.290803	10.296078	10.301351	10.306622	10.311891	10.317158	10.322423	10.327686	10.332947	10.338206	10.343463	10.348718	10.353971	10.359222	10.364471	10.369718	10.374963	10.380206	10.385447	10.390686	10.395923	10.401158	10.406391	10.411622	10.416851	10.422078	10.427303	10.432526	10.437747	10.442966	10.448183	10.453398	10.458611	10.463822	10.469031	10.474238	10.479443	10.484646	10.489847	10.495046	10.500243	10.505438	10.510631	10.515822	10.521011	10.526198	10.531383	10.536566	10.541747	10.546926	10.552103	10.557278	10.562451	10.567622	10.572791	10.577958	10.583123	10.588286	10.593447	10.598606	10.603763	10.608918	10.614071	10.619222	10.624371	10.629518	10.634663	10.639806	10.644947	10.650086	10.655223	10.660358	10.665491	10.670622	10.675751	10.680878	10.686003	10.691126	10.696247	10.701366	10.706483	10.711598	10.716711	10.721822	10.726931	10.732038	10.737143	10.742246	10.747347	10.752446	10.757543	10.762638	10.767731	10.772822	10.777911	10.782998	10.788083	10.793166	10.798247	10.803326	10.808403	10.813478	10.818551	10.823622	10.828691	10.833758	10.838823	10.843886	10.848947	10.854006	10.859063	10.864118	10.869171	10.874222	10.879271	10.884318	10.889363	10.894406	10.899447	10.904486	10.909523	10.914558	10.919591	10.924622	10.929651	10.934678	10.939703	10.944726	10.949747	10.954766	10.959783	10.964798	10.969811	10.974822	10.979831	10.984838	10.989843	10.994846	10.999847	11.004846	11.009843	11.014838	11.019831	11.024822	11.029811	11.034798	11.039783	11.044766	11.049747	11.054726	11.059703	11.064678	11.069651	11.074622	11.079591	11.084558	11.089523	11.094486	11.099447	11.104406	11.109363	11.114318	11.119271	11.124222	11.129171	11.134118	11.139063	11.144006	11.148947	11.153886	11.158823	11.163758	11.168691	11.173622	11.178551	11.183478	11.188403	11.193326	11.198247	11.203166	11.208083	11.212998	11.217911	11.222822	11.227731	11.232638	11.237543	11.242446	11.247347	11.252246	11.257143	11.262038	11.266931	11.271822	11.276711	11.281598	11.286483	11.291366	11.296247	11.301126	11.305991	11.310851	11.315703	11.320558	11.325411	11.330262	11.335111	11.339958	11.344803	11.349646	11.354486	11.359323	11.364158	11.368991	11.373822	11.378651	11.383478	11.388303	11.393126	11.397947	11.402766	11.407583	11.412398	11.417211	11.422022	11.426831	11.431638	11.436443	11.441246	11.446047	11.450846	11.455643	11.460438	11.465231	11.470022	11.474811	11.479598	11.484383	11.489166	11.493947	11.498726	11.503503	11.508278	11.513051	11.517822	11.522591	11.527358	11.532123	11.536886	11.541647	11.546406	11.551163	11.555918	11.560671	11.565422	11.570171	11.574918	11.579663	11.584406	11.589147	11.593886	11.598623	11.603358	11.608091	11.612822	11.617551	11.622278	11.627003	11.631726	11.636447	11.641166	11.645883	11.650598	11.655311	11.659922	11.664531	11.669138	11.673743	11.678346	11.682947	11.687546	11.692143	11.696738	11.701331	11.705922	11.710511	11.715098	11.719683	11.724266	11.728847	11.733426	11.737991	11.742558	11.747123	11.751686	11.756247	11.760806	11.765363	11.769918	11.774471	11.779022	11.783571	11.788118	11.792663	11.797206	11.801747	11.806286	11.810823	11.815358	11.819891	11.824422	11.828951	11.833478	11.838003	11.842526	11.847047	11.851566	11.856083	11.860598	11.865111	11.869622	11.874131	11.878638	11.883143	11.887646	11.892147	11.896646	11.901143	11.905638	11.910131	11.914622	11.919111	11.923598	11.928083	11.932566	11.937047	11.941526	11.945991	11.950458	11.954923	11.959386	11.963847	11.968306	11.972763	11.977218	11.981671	11.986122	11.990571	11.995018	11.999463	12.003906	12.008347	12.012786	12.017223	12.021658	12.026091	12.030522	12.034951	12.039378	12.043803	12.048226	12.052647	12.057066	12.061483	12.065898	12.070311	12.074722	12.079131	12.083538	12.087943	12.092346	12.096747	12.101146	12.105543	12.109938	12.114331	12.118722	12.123111	12.1275

		50 ^m		51 ^m		52 ^m		53 ^m		54 ^m		55 ^m		56 ^m		57 ^m		58 ^m		59 ^m				
		12 deg.				13 deg.				14 deg.														
SEC.		0'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'
0	0	8.073792	8.090922	8.107718	8.124190	8.140352	8.156215	8.171789	8.187085	8.202112	8.216879	60												
1	15	074080	091205	107995	124462	140619	156477	172046	187337	202360	217123	59												
2	30	074368	091487	108272	124734	140886	156739	172303	187590	202608	217367	58												
3	45	074656	091770	108549	125005	141152	157000	172560	187842	202856	217611	57												
4	0	8.074944	8.092052	8.108826	8.125277	8.141419	8.157262	8.172817	8.188095	8.203104	8.217854	56												
5	15	075232	092334	109102	125549	141685	157524	173074	188347	203352	218098	55												
6	30	075520	092617	109379	125820	141952	157785	173331	188599	203600	218342	54												
7	45	075808	092899	109656	126091	142218	158046	173588	188851	203848	218585	53												
8	0	8.076095	8.093181	8.109932	8.126363	8.142484	8.158308	8.173844	8.189104	8.204095	8.218829	52												
9	15	076383	093463	110209	126634	142750	158569	174101	189356	204343	219072	51												
10	30	076670	093744	110485	126905	143016	158830	174357	189608	204591	219316	50												
11	45	076958	094026	110761	127176	143282	159091	174614	189859	204838	219559	49												
12	0	8.077245	8.094308	8.111037	8.127447	8.143548	8.159352	8.174870	8.190111	8.205086	8.219802	48												
13	15	077532	094589	111314	127718	143814	159613	175126	190363	205333	220045	47												
14	30	077819	094871	111590	127989	144080	159874	175382	190615	205580	220288	46												
15	45	078106	095152	111865	128259	144315	160135	175639	190866	205827	220531	45												
16	0	8.078393	8.095433	8.112141	8.128530	8.144611	8.160396	8.175895	8.191118	8.206075	8.220774	44												
17	15	078680	095714	112417	128800	144876	160656	176151	191369	206322	221017	43												
18	30	078967	095995	112693	129071	145142	160917	176406	191621	206569	221260	42												
19	45	079253	096276	112968	129341	145407	161177	176662	191872	206816	221503	41												
20	0	8.079540	8.096557	8.113244	8.129611	8.145672	8.161438	8.176918	8.192123	8.207062	8.221745	40												
21	15	079826	096838	113519	129882	145937	161698	177174	192374	207309	221988	39												
22	30	080113	097119	113794	130152	146203	161958	177429	192625	207556	222230	38												
23	45	080399	097399	114069	130422	146468	162218	177685	192876	207803	222473	37												
24	0	8.080685	8.097680	8.114345	8.130692	8.146733	8.162479	8.177940	8.193127	8.208049	8.222715	36												
25	15	080971	097960	114620	130961	146997	162738	178195	193378	208296	222957	35												
26	30	081257	098241	114895	131231	147262	162998	178451	193629	208542	223200	34												
27	45	081543	098521	115169	131501	147527	163258	178706	193879	208788	223442	33												
28	0	8.081828	8.098801	8.115444	8.131770	8.147791	8.163518	8.178961	8.194130	8.209035	8.223684	32												
29	15	082114	099081	115719	132040	148056	163778	179216	194381	209281	223926	31												
30	30	082400	099361	115993	132309	148320	164037	179471	194631	209527	224168	30												
31	45	082685	099641	116268	132579	148585	164297	179726	194881	209773	224410	29												
32	0	8.082970	8.099921	8.116542	8.132848	8.148849	8.164556	8.179981	8.195132	8.210019	8.224652	28												
33	15	083256	100200	116817	133117	149113	164816	180235	195382	210265	224893	27												
34	30	083541	100480	117091	133386	149377	165075	180490	195632	210511	225135	26												
35	45	083826	100759	117365	133655	149641	165334	180745	195882	210757	225377	25												
36	0	8.084111	8.101039	8.117639	8.133924	8.149905	8.165593	8.180999	8.196132	8.211003	8.225618	24												
37	15	084396	101318	117913	134193	150169	165852	181254	196382	211248	225860	23												
38	30	084681	101597	118187	134461	150433	166111	181508	196632	211494	226101	22												
39	45	084965	101876	118461	134730	150696	166370	181762	196882	211739	226343	21												
40	0	8.085250	8.102156	8.118734	8.134999	8.150960	8.166629	8.182016	8.197132	8.211985	8.226584	20												
41	15	085534	102434	119008	135267	151223	166888	182270	197382	212230	226825	19												
42	30	085819	102713	119282	135535	151487	167146	182525	197631	212475	227066	18												
43	45	086103	102992	119555	135804	151750	167405	182778	197881	212721	227307	17												
44	0	8.086387	8.103271	8.119828	8.136072	8.152013	8.167663	8.183032	8.198130	8.212966	8.227548	16												
45	15	086671	103549	120102	136340	152277	167922	183286	198380	213211	227789	15												
46	30	086956	103828	120375	136608	152540	168180	183540	198629	213456	228030	14												
47	45	087239	104106	120648	136876	152803	168439	183794	198878	213701	228271	13												
48	0	8.087523	8.104385	8.120921	8.137144	8.153066	8.168697	8.184047	8.199127	8.213946	8.228512	12												
49	15	087807	104663	121194	137412	153328	168955	184301	199376	214191	228752	11												
50	30	088091	104941	121467	137680	153591	169213	184554	199625	214435	228993	10												
51	45	088374	105219	121739	137947	153854	169471	184808	199874	214680	229234	9												
52	0	8.088658	8.105497	8.122012	8.138215	8.154117	8.169729	8.185061	8.200123	8.214925	8.229474	8												
53	15	088941	105775	122285	138482	154379	169986	185314	200372	215169	229714	7												
54	30	089224	106053	122557	138750	154642	170244	185567	200621	215414	229955	6												
55	45	089508	106330	122829	139017	154904	170502	185820	200869	215658	230195	5												
56	0	8.089791	8.106608	8.123102	8.139284	8.155166	8.170759	8.186073	8.201118	8.215902	8.230435	4												
57	15	090074	106885	123374	139551	155429	171017	186326	201366	216147	230675	3												
58	30	090357	107163	123646	139818	155691	171274	186579	201615	216391	230915	2												
59	45	090639	107440	123918	140085	155953	171532	186832	201863	216635	231155	1												
60	0	8.090922	8.107718	8.124190	8.140352	8.156215	8.171789	8.187085	8.202112	8.216879	8.231395	0												
		9 ^m		8 ^m		7 ^m		6 ^m		5 ^m		4 ^m												

		0 ^m	1 ^m	2 ^m	3 ^m	4 ^m	5 ^m	6 ^m	7 ^m	8 ^m	9 ^m		
		15 deg.				16 deg.				17 deg.			
°	'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'
0	0	8.231395	8.245669	8.259708	8.273519	8.287111	8.300488	8.313659	8.326629	8.339404	8.351990	60	
1	15	231635	245905	259940	273748	287335	300710	313877	326844	339615	352198	59	
2	30	231875	246141	260172	273976	287560	300931	314095	327058	339827	352406	58	
3	45	232115	246376	260404	274204	287784	301152	314312	327272	340038	352614	57	
4	0	8.232354	8.246612	8.260636	8.274432	8.288009	8.301373	8.314530	8.327487	8.340249	8.352822	56	
5	15	232594	246848	260867	274660	288233	301594	314747	327701	340460	353031	55	
6	30	232833	247083	261099	274888	288458	301815	314965	327915	340671	353238	54	
7	45	233073	247319	261331	275116	288682	302035	315182	328129	340882	353446	53	
8	0	8.233312	8.247554	8.261562	8.275344	8.288906	8.302256	8.315400	8.328344	8.341093	8.353654	52	
9	15	233552	247790	261794	275572	289131	302477	315617	328558	341304	353862	51	
10	30	233791	248025	262025	275800	289355	302698	315835	328772	341515	354070	50	
11	45	234030	248260	262257	276027	289579	302918	316052	328986	341726	354277	49	
12	0	8.234269	8.248495	8.262488	8.276255	8.289803	8.303139	8.316269	8.329200	8.341936	8.354485	48	
13	15	234508	248730	262719	276483	290027	303359	316486	329413	342147	354692	47	
14	30	234747	248965	262951	276710	290251	303580	316703	329627	342358	354900	46	
15	45	234986	249200	263182	276938	290475	303800	316920	329841	342568	355107	45	
16	0	8.235225	8.249435	8.263413	8.277163	8.290699	8.304021	8.317137	8.330055	8.342779	8.355315	44	
17	15	235464	249670	263644	277392	290922	304241	317354	330268	342989	355522	43	
18	30	235703	249905	263875	277620	291146	304461	317571	330482	343200	355730	42	
19	45	235941	250140	264106	277847	291370	304681	317788	330695	343410	355937	41	
20	0	8.236180	8.250374	8.264337	8.278074	8.291593	8.304901	8.318004	8.330909	8.343620	8.356144	40	
21	15	236418	250609	264567	278301	291817	305121	318221	331122	343830	356351	39	
22	30	236657	250843	264798	278528	292040	305341	318438	331336	344041	356558	38	
23	45	236895	251078	265029	278755	292264	305561	318654	331549	344251	356766	37	
24	0	8.237133	8.251312	8.265259	8.278982	8.292487	8.305781	8.318871	8.331762	8.344461	8.356973	36	
25	15	237372	251547	265490	279209	292710	306001	319087	331975	344671	357180	35	
26													

SEC.	10 ^m		11 ^m	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m	SEC.
	17 deg.			18 deg.				19 deg.				
0	0	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0
1	15	364392	376615	8.388665	8.400546	8.412262	8.423818	8.435218	8.446467	8.457568	8.468524	60
2	30	364597	376817	388864	400742	412456	424009	435407	446653	457752	468706	59
3	45	364802	377020	389064	400939	412650	424201	435596	446839	457935	468887	58
4	0	365007	377222	389263	401135	412843	424392	435784	447026	458119	469068	57
5	15	365212	377424	389462	401332	413037	424583	435973	447212	458303	469250	56
6	30	365417	377626	389661	401528	413231	424774	436162	447398	458486	469431	55
7	45	365622	377828	389860	401724	413425	424965	436350	447584	458670	469612	54
8	0	365827	378030	390060	401921	413618	425156	436539	447770	458853	469793	53
9	15	366032	378232	390259	402117	413812	425347	436727	447956	459037	469975	52
10	30	366237	378434	390458	402313	414005	425538	436915	448142	459220	470156	51
11	45	366441	378635	390657	402510	414199	425729	437104	448327	459404	470337	50
12	0	366646	378837	390855	402706	414392	425920	437292	448513	459587	470518	49
13	15	366851	379039	391054	402902	414586	426110	437480	448699	459771	470699	48
14	30	367055	379241	391253	403098	414779	426301	437668	448885	459954	470880	47
15	45	367260	379442	391452	403294	414972	426492	437857	449070	460137	471061	46
16	0	367469	379644	391651	403490	415166	426682	438045	449256	460320	471241	45
17	15	367669	379845	391849	403686	415359	426873	438233	449442	460504	471422	44
18	30	367873	380047	392048	403882	415552	427064	438421	449627	460687	471603	43
19	45	368077	380248	392247	404077	415745	427254	438609	449813	460870	471784	42
20	0	368282	380450	392445	404273	415938	427445	438797	449998	461053	471965	41
21	15	368486	380651	392644	404469	416131	427635	438985	450184	461236	472145	40
22	30	368690	380852	392842	404665	416324	427826	439172	450369	461419	472326	39
23	45	368894	381053	393040	404860	416517	428016	439360	450554	461602	472506	38
24	0	369098	381255	393239	405056	416710	428206	439548	450740	461785	472687	37
25	15	369302	381456	393437	405252	416903	428397	439736	450925	461968	472868	36
26	30	369506	381657	393635	405447	417096	428587	439924	451110	462150	473048	35
27	45	369710	381858	393834	405643	417289	428777	440111	451295	462333	473228	34
28	0	369914	382059	394032	405838	417482	428967	440299	451480	462516	473409	33
29	15	370118	382260	394230	406033	417674	429157	440486	451666	462699	473589	32
30	30	370322	382461	394428	406229	417867	429347	440674	451851	462881	473770	31
31	45	370526	382661	394626	406424	418060	429537	440862	452036	463064	473950	30
32	0	370729	382862	394824	406619	418252	429727	441049	452221	463247	474130	29
33	15	370933	383063	395022	406814	418445	429917	441236	452406	463429	474310	28
34	30	371137	383264	395220	407010	418637	430107	441424	452591	463612	474490	27
35	45	371340	383464	395418	407205	418830	430297	441611	452775	463794	474671	26
36	0	371544	383665	395615	407400	419022	430487	441798	452960	463976	474851	25
37	15	371747	383866	395813	407595	419214	430677	441986	453145	464159	475031	24
38	30	371950	384066	396011	407790	419407	430866	442173	453330	464341	475211	23
39	45	372154	384267	396209	407985	419599	431056	442360	453515	464524	475392	22
40	0	372357	384467	396406	408180	419791	431246	442547	453699	464706	475571	21
41	15	372560	384667	396604	408374	419983	431435	442734	453884	464888	475751	20
42	30	372764	384868	396801	408569	420176	431625	442921	454068	465070	475930	19
43	45	372967	385068	396999	408764	420368	431814	443108	454253	465252	476110	18
44	0	373170	385268	397196	408959	420560	432004	443295	454437	465434	476290	17
45	15	373373	385468	397394	409153	420752	432193	443482	454622	465617	476470	16
46	30	373576	385668	397591	409348	420944	432383	443669	454806	465799	476649	15
47	45	373779	385869	397788	409542	421136	432572	443856	454991	465981	476829	14
48	0	373982	386069	397985	409737	421328	432761	444043	455175	466162	477009	13
49	15	374185	386269	398183	409931	421519	432951	444229	455359	466344	477188	12
50	30	374387	386469	398380	410126	421711	433140	444416	455544	466526	477368	11
51	45	374590	386668	398577	410320	421903	433329	444603	455728	466708	477547	10
52	0	374793	386868	398774	410515	422095	433518	444789	455912	466890	477727	9
53	15	374996	387068	398971	410709	422286	433707	444976	456096	467072	477906	8
54	30	375198	387268	399168	410903	422478	433896	445162	456280	467253	478086	7
55	45	375401	387468	399365	411097	422669	434085	445349	456464	467435	478265	6
56	0	375603	387667	399562	411292	422861	434274	445535	456648	467617	478444	5
57	15	375806	387867	399759	411486	423053	434463	445722	456832	467798	478624	4
58	30	376008	388066	399955	411680	423244	434652	445908	457016	467980	478803	3
59	45	376211	388266	400152	411874	423435	434841	446095	457200	468162	478982	2
60	0	376413	388465	400349	412068	423627	435030	446281	457384	468343	479161	1
61	15	376615	388665	400546	412262	423818	435218	446467	457568	468524	479346	0
62	30	376817	388864	400742	412456	424009	435407	446653	457752	468706	479548	60
63	45	377020	389064	400939	412650	424201	435596	446839	457935	468887	479750	59
64	0	377222	389263	401135	412843	424392	435784	447026	458119	469068	479957	58
65	15	377424	389462	401332	413037	424583	435973	447212	458303	469250	480068	57
66	30	377626	389661	401528	413231	424774	436162	447398	458486	469431	480287	56
67	45	377828	389860	401724	413425	424965	436350	447584	458670	469612	480518	55
68	0	378030	390060	401921	413618	425156	436539	447770	458853	469793	480757	54
69	15	378232	390259	402117	413812	425347	436727	447956	459037	469975	480975	53
70	30	378434	390458	402313	414005	425538	436915	448142	459220	470156	481196	52
71	45	378635	390657	402510	414199	425729	437104	448327	459404	470337	481377	51
72	0	378837	390855	402706	414392	425920	437292	448513	459587	470518	481598	50
73	15	379039	391054	402902	414586	426110	437480	448699	459771	470699	481819	49
74	30	379241	391253	403098	414779	426301	437668	448885	459954	470880	482040	48
75	45	379442	391452	403294	414972	426492	437857	449070	460137	471061	482261	47
76	0	379644	391651	403490	415166	426682	438045	449256	460320	471241	482482	46
77	15	379845	391849	403686	415359	426873	438233	449442	460504	471422	482703	45
78	30	380047	392048	403882	415552	427064	438421	449627	460687	471603	482924	44
79	45	380248	392247	404077	415745	427254	438609	449813	460870	471784	483145	43
80	0	380450	392445	404273	415938	427445	438797	449998	461053	471965	483366	42
81	15	380651	392644	404469	416131	427635	438985	450184	461236	472145	483587	41
82	30	380852	392842	404665	416324	427826	439172	450369	461419	472326	483808	40
83	45	381053	393040	404860	416517	428016	439360	450554	461602	472506	484029	39
84	0	381255	393239	405056	416710	428206	439548	450740	461785	472687	484250	38
85	15	381456	393437	405252	416903	428397	439736	450925	461968	472868	484471	37
86	30	381657	393635	405447	417096	428587	439924	451110	462150	473048	484692	36
87	45	381858	393834	405643	417289	428777	440111	4512				

[illegible]

SEC.	30 ^m		31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m	SEC.			
	22 deg.		23 deg.					24 deg.							
0	0	8.58047	45'	8.589944	3.599311	8.608573	8.617734	8.626795	8.635758	15'	8.644625	30'	8.653399	3.662081	60
1	15	580630	590101	599466	608727	617885	626945	635906	644772	653545	662225	59			
2	30	580789	590258	599621	608880	618037	627095	636055	644919	653690	662369	58			
3	45	580948	590415	599776	609033	618189	627245	636203	645066	653836	662513	57			
4	0	8.581106	8.590572	3.599931	8.609187	8.618341	8.627395	8.636352	8.645213	31'	8.653981	46'	8.662657	56	
5	15	581265	590729	600086	609340	618492	627545	636500	645360	654126	662801	55			
6	30	581424	590886	600242	609494	618644	627695	636649	645507	654272	662945	54			
7	45	581582	591042	600396	609647	618796	627845	636797	645654	654417	663088	53			
8	0	8.581741	8.591199	3.600552	8.609800	8.618947	8.627995	8.636946	8.645801	32'	8.654562	32'	8.663232	52	
9	15	581899	591356	600706	609954	619099	628145	637094	645947	654707	663376	51			
10	30	582058	591513	600862	610107	619251	628295	637242	646094	654853	663520	50			
11	45	582216	591669	601016	610260	619402	628445	637391	646241	654998	663663	49			
12	0	8.582375	8.591826	3.601171	8.610413	8.619554	8.628595	8.637539	8.646388	33'	8.655143	48'	8.663807	48	
13	15	582533	591982	601326	610566	619705	628745	637687	646534	655288	663951	47			
14	30	582691	592139	601481	610720	619857	628895	637835	646681	655433	664094	46			
15	45	582850	592296	601636	610873	620008	629044	637984	646828	655578	664238	45			
16	0	8.583008	8.592452	3.601791	8.611026	8.620160	8.629194	8.638132	8.646974	34'	8.655723	34'	8.664381	44	
17	15	583166	592609	601945	611179	620311	629344	638280	647121	655868	664525	43			
18	30	583325	592765	602100	611332	620462	629494	638428	647267	656014	664668	42			
19	45	583483	592922	602255	611485	620614	629643	638576	647414	656158	664812	41			
20	0	8.583641	8.593078	3.602410	8.611638	8.620765	8.629793	8.638724	8.647560	35'	8.656304	35'	8.664955	40	
21	15	583799	593234	602564	611791	620916	629943	638872	647707	656448	665099	39			
22	30	583957	593391	602719	611944	621067	630092	639020	647853	656593	665242	38			
23	45	584115	593547	602873	612097	621219	630242	639168	648000	656738	665386	37			
24	0	8.584273	8.593703	3.603028	8.612249	8.621370	8.630391	8.639316	8.648146	36'	8.656883	36'	8.665529	36	
25	15	584431	593860	603182	612402	621521	630541	639464	648292	657028	666247	35			
26	30	584589	594016	603337	612555	621672	630691	639612	648439	657173	666381	34			
27	45	584747	594172	603491	612708	621823	630840	639760	648585	657317	666539	33			
28	0	8.584905	8.594328	3.603646	8.612861	8.621974	8.630989	8.639908	8.648731	37'	8.657462	37'	8.666102	32	
29	15	585063	594484	603800	613013	622125	631139	640056	648878	657607	666245	31			
30	30	585221	594641	603955	613166	622276	631288	640203	649024	657752	666389	30			
31	45	585379	594797	604109	613319	622427	631438	640351	649170	657896	666532	29			
32	0	8.585537	8.594953	3.604263	8.613471	8.622578	8.631587	8.640499	8.649316	38'	8.658041	38'	8.666675	28	
33	15	585695	595109	604418	613624	622729	631736	640647	649463	658186	666818	27			
34	30	585853	595265	604572	613776	622880	631886	640794	649609	658330	666961	26			
35	45	586010	595421	604726	613929	623031	632035	640942	649755	658475	667104	25			
36	0	8.586168	8.595577	3.604880	8.614081	8.623182	8.632184	8.641090	8.649901	39'	8.658620	39'	8.667247	24	
37	15	586326	595733	605035	614234	623333	632333	641237	650047	658764	667390	23			
38	30	586483	595888	605189	614386	623484	632482	641385	650193	658909	667533	22			
39	45	586641	596044	605343	614539	623634	632632	641532	650339	659053	667676	21			
40	0	8.586799	8.596200	3.605497	8.614691	8.623785	8.632781	8.641680	8.650485	40'	8.659198	40'	8.667819	20	
41	15	586956	596356	605651	614844	623936	632930	641828	650631	659342	667962	19			
42	30	587114	596512	605805	614996	624087	633079	641975	650777	659486	668105	18			
43	45	587271	596667	605959	615148	624237	633228	642123	650923	659631	668248	17			
44	0	8.587429	8.596823	3.606113	8.615301	8.624388	8.633377	8.642270	8.651069	41'	8.659775	41'	8.668391	16	
45	15	587586	596979	606267	615453	624539	633526	642417	651214	659919	668534	15			
46	30	587743	597135	606421	615605	624689	633675	642565	651360	660064	668677	14			
47	45	587901	597290	606575	615757	624840	633824	642712	651506	660208	668819	13			
48	0	8.588058	8.597446	3.606729	8.615910	8.624990	8.633973	8.642859	8.651652	42'	8.660352	42'	8.668962	12	
49	15	588215	597601	606883	616062	625141	634122	643007	651798	660497	669105	11			
50	30	588373	597757	607036	616214	625291	634271	643154	651943	660641	669248	10			
51	45	588530	597912	607190	616366	625442	634419	643301	652089	660785	669390	9			
52	0	8.588687	8.598068	3.607344	8.616518	8.625592	8.634568	8.643449	8.652235	43'	8.660929	43'	8.669533	8	
53	15	588844	598223	607498	616670	625742	634717	643596	652380	661073	669676	7			
54	30	589002	598375	607651	616822	625893	634866	643743	652526	661217	669818	6			
55	45	589159	598534	607805	616974	626043	635014	643890	652672	661361	669961	5			
56	0	8.589316	8.598689	3.607959	8.617126	8.626194	8.635163	8.644037	8.652817	44'	8.661505	44'	8.670103	4	
57	15	589473	598845	608112	617278	626344	635312	644184	652963	661649	670246	3			
58	30	589630	599000	608266	617430	626494	635461	644331	653108	661793	670389	2			
59	45	589787	599155	608419	617582	626644	635609	644478	653254	661937	670531	1			
60	0	8.589944	8.599311	3.608573	8.617734	8.626795	8.635758	8.644625	8.653399	45'	8.662081	45'	8.670674	0	
SEC.	29 ^m		28 ^m	27 ^m	26 ^m	25 ^m	24 ^m	23 ^m	22 ^m	21 ^m	20 ^m	SEC.			

sec.	25 deg.				26 deg.				27 deg.				sec.
	40 ^m	41 ^m	42 ^m	43 ^m	44 ^m	45 ^m	46 ^m	47 ^m	48 ^m	49 ^m			
0	0	15	30	45	0	15	30	45	0	15			
1	0	8.670674	8.579177	8.687595	8.695927	8.704176	8.712343	8.720431	8.728439	8.736371	8.744226	60	
15		670816	679318	687734	696065	704313	712479	720565	728572	736502	744356	59	
30		670958	679459	687874	696203	704450	712614	720699	728705	736634	744486	58	
45		671101	679600	688013	696341	704586	712750	720833	728838	736765	744617	57	
1	1	16	31	46	1	16	31	46	1	16			
4	0	8.671243	8.679741	8.688153	8.696479	8.704723	8.712885	8.720967	8.728970	8.736897	8.744747	56	
5	15	671385	679882	688292	696618	704860	713020	721101	729103	737028	744877	55	
6	30	671528	680023	688432	696756	704996	713156	721235	729236	737159	745007	54	
7	45	671670	680164	688571	696894	705133	713291	721369	729368	737291	745137	53	
2	2	17	32	47	2	17	32	47	2	17			
8	0	8.671812	8.680305	8.688710	8.697032	8.705270	8.713426	8.721503	8.729501	8.737452	8.745268	52	
9	15	671955	680445	688850	697170	705406	713562	721637	729634	737554	745398	51	
10	30	672097	680586	688989	697308	705543	713697	721771	729766	737685	745528	50	
11	45	672239	680727	689128	697445	705679	713832	721905	729899	737816	745658	49	
3	3	18	33	48	3	18	33	48	3	18			
12	0	8.672381	8.680868	8.689268	8.697583	8.705816	8.713967	8.722039	8.730032	8.737948	8.745788	48	
13	15	672523	681008	689407	697721	705952	714102	722172	730164	738079	745918	47	
14	30	672666	681149	689546	697859	706089	714238	722306	730297	738210	746048	46	
15	45	672808	681290	689685	697997	706225	714373	722440	730429	738341	746178	45	
4	4	19	34	49	4	19	34	49	4	19			
16	0	8.672950	8.681430	8.689825	8.698135	8.706362	8.714508	8.722574	8.730562	8.738473	8.746308	44	
17	15	673092	681571	689964	698273	706498	714643	722708	730694	738604	746438	43	
18	30	673234	681711	690103	698410	706635	714778	722841	730827	738735	746568	42	
19	45	673376	681852	690242	698548	706771	714913	722975	730959	738866	746698	41	
5	5	20	35	50	5	20	35	50	5	20			
20	0	8.673518	8.681993	8.690381	8.698686	8.706980	8.715048	8.723109	8.731022	8.738897	8.746738	40	
21	15	673660	682139	690520	698824	707044	715183	723242	731124	739128	746958	39	
22	30	673802	682274	690660	698961	707180	715318	723376	731356	739260	747087	38	
23	45	673944	682414	690799	699099	707316	715453	723510	731489	739391	747217	37	
6	6	21	36	51	6	21	36	51	6	21			
24	0	8.674086	8.682555	8.690938	8.699237	8.707453	8.715588	8.723643	8.731621	8.739522	8.747347	36	
25	15	674227	682695	691077	699374	707589	715723	723777	731753	739653	747477	35	
26	30	674369	682835	691216	699512	707725	715858	723911	731886	739784	747607	34	
27	45	674511	682976	691354	699649	707861	715993	724044	732018	739915	747736	33	
7	7	22	37	52	7	22	37	52	7	22			
28	0	8.674653	8.683116	8.691493	8.699787	8.707998	8.716127	8.724178	8.732150	8.740046	8.747866	32	
29	15	674795	683256	691632	699924	708134	716262	724311	732282	740177	747996	31	
30	30	674936	683397	691771	700062	708270	716397	724445	732414	740308	748126	30	
31	45	675078	683537	691910	700199	708406	716532	724578	732547	740438	748255	29	
8	8	23	38	53	8	23	38	53	8	23			
32	0	8.675220	8.683677	8.692049	8.700337	8.708542	8.716667	8.724712	8.732679	8.740569	8.748385	28	
33	15	675361	683817	692188	700474	708678	716801	724845	732811	740700	748514	27	
34	30	675503	683958	692327	700612	708814	716936	724978	732943	740831	748644	26	
35	45	675645	684098	692465	700749	708950	717071	725112	733075	740962	748774	25	
9	9	24	39	54	9	24	39	54	9	24			
36	0	8.675786	8.684238	8.692604	8.700886	8.709086	8.717205	8.725245	8.733207	8.741093	8.748903	24	
37	15	675928	684378	692743	701024	709222	717340	725378	733339	741223	749033	23	
38	30	676069	684518	692881	701161	709358	717475	725512	733471	741354	749162	22	
39	45	676211	684658	693020	701298	709494	717609	725645	733603	741485	749292	21	
10	10	25	40	55	10	25	40	55	10	25			
40	0	8.676352	8.684798	8.693159	8.701436	8.709630	8.717744	8.725778	8.733735	8.741616	8.749421	20	
41	15	676494	684938	693297	701573	709766	717878	725912	733867	741746	749551	19	
42	30	676635	685078	693436	701710	709902	718013	726045	733999	741877	749680	18	
43	45	676777	685218	693575	701847	710038	718147	726178	734131	742008	749810	17	
11	11	26	41	56	11	26	41	56	11	26			
44	0	8.676918	8.685358	8.693713	8.701984	8.710173	8.718282	8.726311	8.734263	8.742138	8.749939	16	
45	15	677060	685498	693852	702121	710309	718416	726444	734395	742269	750068	15	
46	30	677201	685638	693990	702259	710445	718551	726578	734527	742400	750198	14	
47	45	677342	685778	694129	702396	710581	718685	726711	734659	742530	750327	13	
12	12	27	42	57	12	27	42	57	12	27			
48	0	8.677484	8.685918	8.694267	8.702533	8.710716	8.718820	8.726844	8.734790	8.742661	8.750457	12	
49	15	677625	686058	694406	702670	710852	718954	726977	734922	742791	750586	11	
50	30	677766	686198	694544	702807	710988	719083	727110	735054	742922	750715	10	
51	45	677907	686337	694682	702944	711123	719223	727243	735186	743052	750844	9	
13	13	28	43	58	13	28	43	58	13	28			
52	0	8.678049	8.686477	8.694821	8.703081	8.711259	8.719357	8.727376	8.735317	8.743183	8.750974	8	
53	15	678190	686617	694959	703218	711395	719491	727509	735449	743313	751103	7	
54	30	678331	686757	695097	703355	711530	719626	727642	735581	743444	751232	6	
55	45	678472	686896	695236	703492	711666	719760	727775	735712	743574	751361	5	
14	14	29	44	59	14	29	44	59	14	29			
56	0	8.678613	8.687036	8.695374	8.703629	8.711801	8.719894	8.727908	8.735844	8.743705	8.751490	4	
57	15	678754	687176	695512	703765	711937	720028	728041	735976	743835	751620	3	
58	30	678895	687315	695651	703902	712073	720162	728174	736107	743965	751749	2	
59	45	679036	687455	695789	704039	712208	720297	728306	736239	744096	751878	1	
60	0	8.679177	8.687595	8.695927	8.704176	8.712343	8.720431	8.728439	8.736371	8.744226	8.752007	0	
15	15	19 ^m	18 ^m	17 ^m	16 ^m	15 ^m	14 ^m	13 ^m	12 ^m	11 ^m	10 ^m		sec.

		50 ^m		51 ^m		52 ^m		53 ^m		54 ^m		55 ^m		56 ^m		57 ^m		58 ^m		59 ^m					
		27 deg.				28 deg.				29 deg.															
sec.		30'	45'		0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'		
0	0	8.752007	8.759715	8.767350	8.774916	8.782411	8.789839	8.797199	8.804494	8.811723	8.818889	8.825920	8.832920	8.839889	8.846820	8.853720	8.860590	8.867430	8.874240	8.881020	8.887770	8.894490	8.901170		
1	15	752136	759842	767477	775041	782536	789962	797321	804615	811843	819008	826118	833173	840173	847118	854008	860843	867623	874348	881018	887633	894193	899698		
2	30	752265	759970	767604	775167	782660	790085	797443	804736	811963	819127	826237	833292	840292	847237	854118	860943	867713	874428	881088	887693	894198	899653		
3	45	752394	760098	767730	775292	782784	790208	797566	804857	812083	819246	826356	833411	840411	847356	854237	861063	867833	874548	881208	887813	894268	899673		
4	0	8.752523	8.760226	8.767857	8.775417	8.782909	8.790332	8.797688	8.804978	8.812203	8.819365	8.826465	8.833515	8.840515	8.847465	8.854365	8.861215	8.868015	8.874765	8.881465	8.888115	8.894715	8.901265		
5	15	752652	760353	767983	775543	783033	790455	797810	805099	812323	819484	826594	833654	840664	847614	854514	861364	868164	874909	881599	888234	894814	899969		
6	30	752781	760481	768110	775668	783157	790578	797932	805220	812443	819602	826712	833772	840782	847732	854682	861582	868432	875146	881836	888471	894951	900356		
7	45	752910	760609	768237	775794	783281	790701	798054	805341	812563	819721	826831	833891	840901	847851	854751	861601	868401	875146	881836	888471	894951	900356		
8	0	8.753039	8.760737	8.768363	8.775919	8.783406	8.790824	8.798176	8.805461	8.812683	8.819840	8.826940	8.834000	8.841020	8.848000	8.854940	8.861840	8.868690	8.875490	8.882240	8.888940	8.895590	8.902190		
9	15	753168	760864	768490	776044	783530	790947	798298	805582	812802	819959	827069	834129	841149	848119	855049	861929	868759	875529	882249	888919	895499	901994		
10	30	753296	760992	768616	776170	783654	791070	798420	805703	812922	820078	827188	834248	841268	848238	855158	862018	868828	875588	882298	888958	895438	901843		
11	45	753425	761120	768743	776295	783778	791193	798541	805824	813042	820196	827266	834286	841256	848176	855046	861856	868606	875356	882056	888706	895086	901411		
12	0	8.753554	8.761247	8.768869	8.776420	8.783902	8.791316	8.798663	8.805945	8.813162	8.820315	8.827405	8.834435	8.841405	8.848315	8.855165	8.861955	8.868685	8.875355	8.881965	8.888515	8.894965	8.901315		
13	15	753683	761375	768995	776545	784026	791439	798785	806066	813281	820434	827524	834564	841554	848494	855384	862214	868984	875634	882264	888784	895194	901499		
14	30	753812	761503	769122	776671	784150	791562	798907	806186	813401	820554	827644	834684	841674	848614	855504	862334	869104	875704	882294	888774	895044	901209		
15	45	753941	761630	769248	776796	784274	791683	799029	806307	813521	820674	827764	834804	841794	848734	855614	862444	869214	875764	882244	888604	894854	900909		
16	0	8.754069	8.761758	8.769375	8.776921	8.784399	8.791808	8.799151	8.806428	8.813641	8.820790	8.827880	8.834920	8.841910	8.848850	8.855740	8.862580	8.869370	8.876110	8.882800	8.889440	8.895990	8.902480		
17	15	754198	761885	769501	777046	784523	791931	799273	806549	813760	820908	827998	835038	842028	848968	855858	862688	869458	876168	882818	889358	895788	902113		
18	30	754327	762013	769627	777172	784647	792054	799395	806669	813880	821027	828117	835157	842147	849087	856017	862837	869597	876297	882937	889417	895747	901967		
19	45	754456	762140	769754	777297	784771	792177	799516	806790	813999	821145	828235	835275	842265	849145	856015	862725	869375	875915	882445	888865	895185	901295		
20	0	8.754584	8.762268	8.769880	8.777422	8.784895	8.792300	8.799638	8.806911	8.814119	8.821264	8.828344	8.835364	8.842324	8.849224	8.856064	8.862844	8.869564	8.876224	8.882844	8.889404	8.895814	8.902074		
21	15	754713	762395	770006	777547	785019	792423	799760	807031	814239	821382	828462	835482	842452	849372	856232	863032	869772	876452	883072	889532	895882	902032		
22	30	754841	762523	770132	777672	785143	792545	799882	807152	814358	821501	828581	835601	842571	849491	856351	863151	869891	876571	883191	889651	895901	901951		
23	45	754970	762650	770259	777797	785266	792668	799903	807123	814278	821368	828398	835418	842318	849118	855818	862518	869118	875618	882018	888318	894468	900418		
24	0	8.755099	8.762777	8.770385	8.777922	8.785390	8.792791	8.800125	8.807393	8.814597	8.821738	8.828818	8.835838	8.842798	8.849698	8.856538	8.863318	8.869938	8.876498	8.882998	8.889438	8.895788	8.902038		
25	15	755227	762905	770511	778047	785514	792914	800247	807514	814717	821856	828936	835956	842916	849816	856656	863436	869956	876416	882816	889116	895266	901316		
26	30	755356	763032	770637	778172	785638	793037	800368	807635	814836	821975	829055	836075	843035	849935	856775	863555	869975	876335	882635	888875	894925	900875		
27	45	755484	763159	770763	778297	785762	793159	800490	807755	814956	822095	829175	836205	843175	849975	856715	863405	869725	875985	882185	888325	894305	900155		
28	0	8.755613	8.763287	8.770889	8.778422	8.785886	8.793282	8.800612	8.807876	8.815075	8.822212	8.829282	8.836292	8.843242	8.850132	8.856962	8.863732	8.869942	8.876592	8.883132	8.889562	8.895882	8.902102		
29	15	755741	763414	771016	778547	786010	793405	800733	807996	815195	822330	829400	836410	843360	850250	857080	863850	869960	876400	882820	889120	895270	901270		
30	30	755870	763541	771142	778672	786134	793527	800855	808117	815314	822449	829519	836529	843479	850369	857199	863969	869969	876289	882589	888769	894819	900719		
31	45	755998	763669	771268	778797	786257	793650	800976	808237	815434	822569	829639	836649	843599	850489	857319	864089	869789	875829	881809	887729	893579	899279		
32	0	8.756127	8.763796	8.771394	8.778922	8.786381	8.793773	8.801098	8.808358	8.815553	8.822685	8.829705	8.836715	8.843615	8.850505	8.857285	8.864055	8.869955	8.876195	8.882315	8.888315	8.894265	8.900065		
33	15	756255	763923	771520	779047	786505	793895	801219	808478	815672	822802	829862	836862	843802	850682	857502	864262	869962	875902	881822	887632	893332	898922		
34	30	756383	764050	771646	779172	786629	794018	801341	808599	815792	822922	830002	837022	844002	850922	857782	864582	869982	875722	881502	887222	892832	898332		
35	45	756512	764177	771772	779296	786752	794140	801462	808719	815911	823046	830126	837146	844106	851006	857846	864626	869926	875566	881246	886866	892366	897746		
36	0	8.756640	8.764305	8.771898	8.779421	8.786876	8.794263	8.801584	8.808839	8.816031	8.823159	8.830229	8.837249	8.844209	8.851109	8.857949	8.864729	8.871449	8.878109	8.884709	8.891249	8.897729	8.904149		
37	15	756768	764432	772024	779546	787000	794386	801705	808960	816150	823277	830347	837357	844307	851197	858027	864797	869997	875637	881317	886937	892437	897817		
38	30	756897	764559	772150	779671	787123	794508	801827	809080	816269	823399	830469	837479	844429	851319	858149	864919	869919	875459	881079	886639	892139	897479		
39	45	757025	764686	772276	779796	787247	794631	801948	809190	816368	823488	830548	837548	844508	851408	858238	864968	869968	875408	880928	88				

	0 ^m	1 ^m	2 ^m	3 ^m	4 ^m	5 ^m	6 ^m	7 ^m	8 ^m	9 ^m		
	30 deg				31 deg.				32 deg.			
0	0	0	0	0	0	0	0	0	0	0	0	0
1	15	15	15	15	15	15	15	15	15	15	15	15
2	30	30	30	30	30	30	30	30	30	30	30	30
3	45	45	45	45	45	45	45	45	45	45	45	45
4	0	0	0	0	0	0	0	0	0	0	0	0
5	15	15	15	15	15	15	15	15	15	15	15	15
6	30	30	30	30	30	30	30	30	30	30	30	30
7	45	45	45	45	45	45	45	45	45	45	45	45
8	0	0	0	0	0	0	0	0	0	0	0	0
9	15	15	15	15	15	15	15	15	15	15	15	15
10	30	30	30	30	30	30	30	30	30	30	30	30
11	45	45	45	45	45	45	45	45	45	45	45	45
12	0	0	0	0	0	0	0	0	0	0	0	0
13	15	15	15	15	15	15	15	15	15	15	15	15
14	30	30	30	30	30	30	30	30	30	30	30	30
15	45	45	45	45	45	45	45	45	45	45	45	45
16	0	0	0	0	0	0	0	0	0	0	0	0
17	15	15	15	15	15	15	15	15	15	15	15	15
18	30	30	30	30	30	30	30	30	30	30	30	30
19	45	45	45	45	45	45	45	45	45	45	45	45
20	0	0	0	0	0	0	0	0	0	0	0	0
21	15	15	15	15	15	15	15	15	15	15	15	15
22	30	30	30	30	30	30	30	30	30	30	30	30
23	45	45	45	45	45	45	45	45	45	45	45	45
24	0	0	0	0	0	0	0	0	0	0	0	0
25	15	15	15	15	15	15	15	15	15	15	15	15
26	30	30	30	30	30	30	30	30	30	30	30	30
27	45	45	45	45	45	45	45	45	45	45	45	45
28	0	0	0	0	0	0	0	0	0	0	0	0
29	15	15	15	15	15	15	15	15	15	15	15	15
30	30	30	30	30	30	30	30	30	30	30	30	30
31	45	45	45	45	45	45	45	45	45	45	45	45
32	0	0	0	0	0	0	0	0	0	0	0	0
33	15	15	15	15	15	15	15	15	15	15	15	15
34	30	30	30	30	30	30	30	30	30	30	30	30
35	45	45	45	45	45	45	45	45	45	45	45	45
36	0	0	0	0	0	0	0	0	0	0	0	0
37	15	15	15	15	15	15	15	15	15	15	15	15
38	30	30	30	30	30	30	30	30	30	30	30	30
39	45	45	45	45	45	45	45	45	45	45	45	45
40	0	0	0	0	0	0	0	0	0	0	0	0
41	15	15	15	15	15	15	15	15	15	15	15	15
42	30	30	30	30	30	30	30	30	30	30	30	30
43	45	45	45	45	45	45	45	45	45	45	45	45
44	0	0	0	0	0	0	0	0	0	0	0	0
45	15	15	15	15	15	15	15	15	15	15	15	15
46	30	30	30	30	30	30	30	30	30	30	30	30
47	45	45	45	45	45	45	45	45	45	45	45	45
48	0	0	0	0	0	0	0	0	0	0	0	0
49	15	15	15	15	15	15	15	15	15	15	15	15
50	30	30	30	30	30	30	30	30	30	30	30	30
51	45	45	45	45	45	45	45	45	45	45	45	45
52	0	0	0	0	0	0	0	0	0	0	0	0
53	15	15	15	15	15	15	15	15	15	15	15	15
54	30	30	30	30	30	30	30	30	30	30	30	30
55	45	45	45	45	45	45	45	45	45	45	45	45
56	0	0	0	0	0	0	0	0	0	0	0	0
57	15	15	15	15	15	15	15	15	15	15	15	15
58	30	30	30	30	30	30	30	30	30	30	30	30
59	45	45	45	45	45	45	45	45	45	45	45	45
60	0	0	0	0	0	0	0	0	0	0	0	0
	59 ^m	58 ^m	57 ^m	56 ^m	55 ^m	54 ^m	53 ^m	52 ^m	51 ^m	50 ^m		

SEC.	10 ^m		11 ^m		12 ^m		13 ^m		14 ^m		15 ^m		16 ^m		17 ^m		18 ^m		19 ^m		SEC.
	32 deg.				33 deg.				34 deg.												
	30'	31'	32'	33'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	
0	8.893785	8.900261	8.906684	8.913055	8.919377	8.925648	8.931871	8.938045	8.944171	8.950251	60										
1	893894	900368	906790	913161	919482	925752	931974	938147	944273	950351	59										
2	894002	900475	906897	913267	919587	925856	932077	938250	944375	950452	58										
3	894110	900583	907003	913373	919691	925960	932180	938352	944476	950553	57										
4	8.894219	8.900690	8.907110	8.913478	8.919796	8.926065	8.932284	8.938455	8.944578	8.950654	56										
5	894327	900798	907216	913584	919901	926169	932387	938557	944680	950755	55										
6	894435	900905	907323	913690	920006	926273	932490	938660	944781	950856	54										
7	894544	901013	907430	913795	920111	926377	932593	938762	944883	950957	53										
8	8.894652	8.901120	8.907536	8.913901	8.920216	8.926481	8.932697	8.938864	8.944984	8.951058	52										
9	894760	901227	907643	914007	920321	926585	932800	938967	945086	951158	51										
10	894868	901335	907749	914112	920425	926689	932903	939069	945188	951259	50										
11	894976	901442	907855	914218	920530	926793	933006	939171	945289	951360	49										
12	8.895085	8.901549	8.907962	8.914324	8.920635	8.926897	8.933109	8.939274	8.945391	8.951461	48										
13	895193	901657	908068	914429	920740	927000	933212	939376	945492	951562	47										
14	895301	901764	908175	914535	920844	927104	933316	939479	945594	951662	46										
15	895409	901871	908281	914640	920949	927208	933419	939581	945695	951763	45										
16	8.895517	8.901978	8.908388	8.914746	8.921054	8.927312	8.933522	8.939683	8.945797	8.951864	44										
17	895625	902086	908494	914852	921159	927416	933625	939785	945898	951965	43										
18	895734	902193	908600	914957	921263	927520	933728	939888	946000	952065	42										
19	895842	902300	908707	915063	921368	927624	933831	939990	946101	952166	41										
20	8.895950	8.902407	8.908813	8.915168	8.921473	8.927728	8.933934	8.940092	8.946203	8.952267	40										
21	896058	902514	908919	915274	921577	927832	934037	940194	946304	952367	39										
22	896166	902622	909026	915379	921682	927935	934140	940297	946406	952468	38										
23	896274	902729	909132	915484	921787	928039	934243	940399	946507	952569	37										
24	8.896382	8.902838	8.909234	8.915590	8.921891	8.928143	8.934449	8.940511	8.946609	8.952666	36										
25	896490	902943	909345	915695	921996	928247	934449	940603	946710	952770	35										
26	896598	903050	909451	915801	922100	928351	934552	940705	946811	952871	34										
27	896706	903157	909557	915906	922205	928454	934655	940808	946913	952971	33										
28	8.896814	8.903264	8.909663	8.916012	8.922310	8.928558	8.934758	8.940910	8.947014	8.953072	32										
29	896922	903371	909770	916117	922414	928662	934861	941012	947115	953172	31										
30	897030	903479	909876	916222	922519	928766	934964	941114	947217	953273	30										
31	897137	903586	909982	916328	922623	928869	935067	941216	947318	953373	29										
32	8.897245	8.903693	8.910088	8.916433	8.922728	8.928973	8.935170	8.941318	8.947419	8.953474	28										
33	897353	903800	910194	916538	922832	929077	935272	941420	947521	953574	27										
34	897461	903907	910301	916644	922937	929180	935375	941522	947622	953675	26										
35	897569	904014	910407	916749	923041	929284	935478	941624	947723	953775	25										
36	8.897677	8.904121	8.910513	8.916854	8.923146	8.929388	8.935581	8.941726	8.947824	8.953876	24										
37	897785	904228	910619	916959	923250	929491	935684	941828	947926	953976	23										
38	897892	904334	910725	917065	923354	929595	935787	941930	948027	954077	22										
39	898000	904441	910831	917170	923459	929698	935889	942032	948128	954177	21										
40	8.898108	8.904548	8.910937	8.917275	8.923563	8.929802	8.935992	8.942134	8.948229	8.954278	20										
41	898216	904655	911043	917380	923668	929905	936095	942236	948330	954378	19										
42	898324	904762	911149	917486	923772	930009	936198	942338	948432	954479	18										
43	898431	904869	911255	917591	923876	930112	936300	942440	948533	954579	17										
44	8.898539	8.904976	8.911361	8.917696	8.923981	8.930216	8.936403	8.942542	8.948634	8.954679	16										
45	898647	905083	911467	917801	924085	930320	936506	942644	948735	954780	15										
46	898754	905190	911573	917906	924189	930423	936608	942746	948836	954880	14										
47	898862	905296	911679	918011	924294	930527	936711	942848	948937	954980	13										
48	8.898970	8.905403	8.911785	8.918116	8.924398	8.930630	8.936814	8.942950	8.949038	8.955081	12										
49	899077	905510	911891	918222	924502	930733	936916	943052	949139	955181	11										
50	899185	905617	911997	918327	924606	930837	937019	943153	949241	955281	10										
51	899293	905723	912103	918432	924711	930940	937122	943255	949342	955381	9										
52	8.899400	8.905830	8.912209	8.918537	8.924815	8.931044	8.937224	8.943357	8.949443	8.955482	8										
53	899508	905937	912315	918642	924919	931147	937327	943459	949544	955582	7										
54	899615	906044	912421	918747	925023	931251	937430	943561	949645	955682	6										
55	899723	906150	912526	918852	925127	931354	937532	943662	949746	955783	5										
56	8.899831	8.906257	8.912632	8.918957	8.925232	8.931457	8.937635	8.943764	8.949847	8.955883	4										
57	899938	906364	912738	919062	925336	931561	937737	943866	949948	955983	3										
58	900046	906470	912844	919167	925440	931664	937840	943968	950049	956083	2										
59	8900153	906577	912950	919272	925544	931767	937942	944069	950150	956183	1										
60	8.900261	8.906684	8.913055	8.919377	8.925648	8.931871	8.938045	8.944171	8.950251	8.956284	0										
sec.	49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m	sec.										

		20 ^m				21 ^m				22 ^m				23 ^m				24 ^m				25 ^m				26 ^m				27 ^m				28 ^m				29 ^m													
		35 deg.																36 deg.																37 deg.																	
		0'				15'				30'				45'				0'				15'				30'				45'				0'				15'				C									
SEC	ARC	0	0	8.956284	8.962271	8.968213	8.974111	8.979965	8.985775	8.991543	8.997269	9.002953	9.008596	9.014198	0	0	8.956284	8.962271	8.968213	8.974111	8.979965	8.985775	8.991543	8.997269	9.002953	9.008596	9.014198	0	0	8.956284	8.962271	8.968213	8.974111	8.979965	8.985775	8.991543	8.997269	9.002953	9.008596	9.014198	0	0									
		15	15	956384	962370	968312	974209	980062	985872	991639	997364	003047	008690	014342	15	15	956384	962370	968312	974209	980062	985872	991639	997364	003047	008690	014342	15	15	956384	962370	968312	974209	980062	985872	991639	997364	003047	008690	014342	15	15									
		30	30	956484	962470	968410	974307	980159	985968	991735	997459	003142	008783	014435	30	30	956484	962470	968410	974307	980159	985968	991735	997459	003142	008783	014435	30	30	956484	962470	968410	974307	980159	985968	991735	997459	003142	008783	014435	30	30									
		45	45	956584	962569	968509	974405	980256	986065	991830	997554	003236	008877	014527	45	45	956584	962569	968509	974405	980256	986065	991830	997554	003236	008877	014527	45	45	956584	962569	968509	974405	980256	986065	991830	997554	003236	008877	014527	45	45									
		60	0	8.956684	8.962668	8.968608	8.974502	8.980353	8.986161	8.991926	8.997649	9.003330	9.008971	9.014596	60	0	8.956684	8.962668	8.968608	8.974502	8.980353	8.986161	8.991926	8.997649	9.003330	9.008971	9.014596	60	0	8.956684	8.962668	8.968608	8.974502	8.980353	8.986161	8.991926	8.997649	9.003330	9.008971	9.014596	60	0									
		15	15	956784	962768	968706	974600	980451	986258	992022	997744	003425	009064	014655	15	15	956784	962768	968706	974600	980451	986258	992022	997744	003425	009064	014655	15	15	956784	962768	968706	974600	980451	986258	992022	997744	003425	009064	014655	15	15									
		30	30	956884	962867	968805	974698	980548	986354	992118	997839	003519	009158	014746	30	30	956884	962867	968805	974698	980548	986354	992118	997839	003519	009158	014746	30	30	956884	962867	968805	974698	980548	986354	992118	997839	003519	009158	014746	30	30									
		45	45	956984	962966	968903	974796	980645	986450	992213	997934	003613	009252	014837	45	45	956984	962966	968903	974796	980645	986450	992213	997934	003613	009252	014837	45	45	956984	962966	968903	974796	980645	986450	992213	997934	003613	009252	014837	45	45									
		60	0	8.957085	8.963066	8.969002	8.974894	8.980742	8.986554	8.992309	8.998029	9.003708	9.009345	9.014931	60	0	8.957085	8.963066	8.969002	8.974894	8.980742	8.986554	8.992309	8.998029	9.003708	9.009345	9.014931	60	0	8.957085	8.963066	8.969002	8.974894	8.980742	8.986554	8.992309	8.998029	9.003708	9.009345	9.014931	60	0									
		15	15	957185	963165	969101	974992	980839	986646	992405	998124	003802	009439	015025	15	15	957185	963165	969101	974992	980839	986646	992405	998124	003802	009439	015025	15	15	957185	963165	969101	974992	980839	986646	992405	998124	003802	009439	015025	15	15									
		30	30	957285	963264	969199	975090	980936	986750	992500	998219	003906	009532	015116	30	30	957285	963264	969199	975090	980936	986750	992500	998219	003906	009532	015116	30	30	957285	963264	969199	975090	980936	986750	992500	998219	003906	009532	015116	30	30									
		45	45	957385	963364	969298	975187	981033	986856	992606	998314	004000	009626	015207	45	45	957385	963364	969298	975187	981033	986856	992606	998314	004000	009626	015207	45	45	957385	963364	969298	975187	981033	986856	992606	998314	004000	009626	015207	45	45									
		60	0	8.957485	8.963463	8.969396	8.975285	8.981130	8.986932	8.992692	8.998409	9.004085	9.009720	9.015311	60	0	8.957485	8.963463	8.969396	8.975285	8.981130	8.986932	8.992692	8.998409	9.004085	9.009720	9.015311	60	0	8.957485	8.963463	8.969396	8.975285	8.981130	8.986932	8.992692	8.998409	9.004085	9.009720	9.015311	60	0									
		15	15	957585	963562	969495	975383	981227	987029	992787	998504	004179	009813	015397	15	15	957585	963562	969495	975383	981227	987029	992787	998504	004179	009813	015397	15	15	957585	963562	969495	975383	981227	987029	992787	998504	004179	009813	015397	15	15									
		30	30	957685	963661	969593	975481	981324	987125	992883	998599	004273	009907	015488	30	30	957685	963661	969593	975481	981324	987125	992883	998599	004273	009907	015488	30	30	957685	963661	969593	975481	981324	987125	992883	998599	004273	009907	015488	30	30									
		45	45	957785	963761	969692	975578	981421	987221	992978	998694	004367	010000	015579	45	45	957785	963761	969692	975578	981421	987221	992978	998694	004367	010000	015579	45	45	957785	963761	969692	975578	981421	987221	992978	998694	004367	010000	015579	45	45									
		60	0	8.957885	8.963860	8.969790	8.975676	8.981518	8.987318	8.993074	8.998789	9.004462	9.010094	9.015681	60	0	8.957885	8.963860	8.969790	8.975676	8.981518	8.987318	8.993074	8.998789	9.004462	9.010094	9.015681	60	0	8.957885	8.963860	8.969790	8.975676	8.981518	8.987318	8.993074	8.998789	9.004462	9.010094	9.015681	60	0									
		15	15	957985	963959	969889	975774	981615	987414	993170	998883	004556	010187	015772	15	15	957985	963959	969889	975774	981615	987414	993170	998883	004556	010187	015772	15	15	957985	963959	969889	975774	981615	987414	993170	998883	004556	010187	015772	15	15									
		30	30	958085	964058	969987	975872	981712	987510	993265	998978	004650	010281	015863	30	30	958085	964058	969987	975872	981712	987510	993265	998978	004650	010281	015863	30	30	958085	964058	969987	975872	981712	987510	993265	998978	004650	010281	015863	30	30									
		45	45	958184	964157	970086	975969	981809	987606	993361	999073	004744	010374	015954	45	45	958184	964157	970086	975969	981809	987606	993361	999073	004744	010374	015954	45	45	958184	964157	970086	975969	981809	987606	993361	999073	004744	010374	015954	45	45									
		60	0	8.958284	8.964257	8.970184	8.976067	8.981906	8.987703	8.993456	8.999168	9.004833	9.010468	9.016061	60	0	8.958284	8.964257	8.970184	8.976067	8.981906	8.987703	8.993456	8.999168	9.004833	9.010468	9.016061	60	0	8.958284	8.964257	8.970184	8.976067	8.981906	8.987703	8.993456	8.999168	9.004833	9.010468	9.016061	60	0									
		15	15	958384	964356	970282	976165	982003	987799	993552	999263	004933	010561	016153	15	15	958384	964356	970282	976165	982003	987799	993552	999263	004933	010561	016153	15	15	958384	964356	970282	976165	982003	987799	993552	999263	004933	010561	016153	15	15									
		30	30	958484	964455	970381	976262	982100	987895	993647	999358	005027	010655	016246	30	30	958484	964455	970381	976262	982100	987895	993647	999358	005027	010655	016246	30	30	958484	964455	970381	976262	982100	987895	993647	999358	005027	010655	016246	30	30									
		45	45	958584	964554	970479	976360	982197	987991	993743	999453	005121	010743	016337	45	45	958584	964554	970479	976360	982197	987991	993743	999453	005121	010743	016337	45	45	958584	964554	970479	976360	982197	987991	993743	999453	005121	010743	016337	45	45									
		60	0	8.958684	8.964653	8.970578	8.976458	8.982294	8.988088	8.993838	8.999547	9.005215	9.010842	9.016436	60	0	8.958684	8.964653	8.970578	8.976458	8.982294	8.988088	8.9																												

	30 ^m	31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m	
	37 deg.					38 deg.					
	30'	45'	30'	45'	30'	45'	30'	45'	30'	45'	
0	0.014198	0.019761	0.025284	0.030768	0.036213	0.041621	0.046991	0.052323	0.057619	0.062879	60
1	0.014291	0.019853	0.025375	0.030859	0.036304	0.041710	0.047080	0.052412	0.057707	0.062967	59
2	0.014384	0.019946	0.025467	0.030950	0.036394	0.041800	0.047169	0.052500	0.057795	0.063054	58
3	0.014477	0.020038	0.025559	0.031041	0.036484	0.041890	0.047258	0.052589	0.057883	0.063141	57
4	0.014570	0.020130	0.025651	0.031132	0.036575	0.041980	0.047347	0.052677	0.057971	0.063229	56
5	0.014663	0.020223	0.025742	0.031223	0.036665	0.042070	0.047436	0.052766	0.058059	0.063316	55
6	0.014756	0.020315	0.025834	0.031314	0.036756	0.042159	0.047525	0.052855	0.058147	0.063403	54
7	0.014849	0.020407	0.025926	0.031405	0.036846	0.042249	0.047615	0.052943	0.058235	0.063491	53
8	0.014942	0.020500	0.026017	0.031496	0.036936	0.042339	0.047704	0.053032	0.058323	0.063578	52
9	0.015035	0.020592	0.026109	0.031587	0.037027	0.042429	0.047793	0.053120	0.058411	0.063665	51
10	0.015128	0.020684	0.026201	0.031678	0.037117	0.042518	0.047882	0.053208	0.058499	0.063752	50
11	0.015221	0.020776	0.026292	0.031769	0.037207	0.042608	0.047971	0.053297	0.058586	0.063840	49
12	0.015314	0.020869	0.026384	0.031860	0.037298	0.042698	0.048060	0.053385	0.058674	0.063927	48
13	0.015407	0.020961	0.026475	0.031951	0.037388	0.042787	0.048149	0.053474	0.058762	0.064014	47
14	0.015500	0.021053	0.026567	0.032042	0.037478	0.042877	0.048238	0.053562	0.058850	0.064101	46
15	0.015593	0.021145	0.026658	0.032133	0.037569	0.042967	0.048327	0.053651	0.058938	0.064189	45
16	0.015686	0.021237	0.026750	0.032224	0.037659	0.043056	0.048416	0.053739	0.059026	0.064276	44
17	0.015778	0.021330	0.026841	0.032315	0.037749	0.043146	0.048505	0.053827	0.059113	0.064363	43
18	0.015871	0.021422	0.026933	0.032405	0.037839	0.043236	0.048594	0.053916	0.059201	0.064450	42
19	0.015964	0.021514	0.027025	0.032496	0.037930	0.043325	0.048683	0.054004	0.059289	0.064537	41
20	0.016057	0.021606	0.027116	0.032587	0.038020	0.043415	0.048772	0.054093	0.059377	0.064625	40
21	0.016150	0.021698	0.027208	0.032678	0.038110	0.043504	0.048861	0.054181	0.059464	0.064712	39
22	0.016243	0.021791	0.027299	0.032769	0.038200	0.043594	0.048950	0.054269	0.059552	0.064799	38
23	0.016335	0.021883	0.027391	0.032860	0.038291	0.043683	0.049039	0.054358	0.059640	0.064886	37
24	0.016428	0.021975	0.027482	0.032951	0.038381	0.043773	0.049128	0.054446	0.059728	0.064973	36
25	0.016521	0.022067	0.027573	0.033041	0.038471	0.043863	0.049217	0.054534	0.059815	0.065060	35
26	0.016614	0.022159	0.027665	0.033132	0.038561	0.043952	0.049306	0.054623	0.059903	0.065147	34
27	0.016706	0.022251	0.027756	0.033223	0.038651	0.044042	0.049395	0.054711	0.059991	0.065234	33
28	0.016799	0.022343	0.027848	0.033314	0.038741	0.044131	0.049484	0.054799	0.060078	0.065322	32
29	0.016892	0.022435	0.027939	0.033404	0.038832	0.044221	0.049573	0.054888	0.060166	0.065409	31
30	0.016985	0.022527	0.028031	0.033495	0.038922	0.044310	0.049661	0.054976	0.060254	0.065496	30
31	0.017077	0.022619	0.028122	0.033586	0.039012	0.044400	0.049750	0.055064	0.060341	0.065583	29
32	0.017170	0.022711	0.028213	0.033677	0.039102	0.044489	0.049839	0.055152	0.060429	0.065670	28
33	0.017263	0.022803	0.028305	0.033767	0.039192	0.044579	0.049928	0.055241	0.060517	0.065757	27
34	0.017355	0.022895	0.028396	0.033858	0.039282	0.044668	0.050017	0.055329	0.060604	0.065844	26
35	0.017448	0.022987	0.028487	0.033949	0.039372	0.044758	0.050106	0.055417	0.060692	0.065931	25
36	0.017541	0.023079	0.028579	0.034040	0.039462	0.044847	0.050195	0.055505	0.060780	0.066018	24
37	0.017633	0.023171	0.028670	0.034130	0.039552	0.044936	0.050283	0.055593	0.060867	0.066105	23
38	0.017726	0.023263	0.028762	0.034221	0.039642	0.045026	0.050372	0.055682	0.060955	0.066192	22
39	0.017818	0.023355	0.028853	0.034312	0.039732	0.045115	0.050461	0.055770	0.061042	0.066279	21
40	0.017911	0.023447	0.028944	0.034402	0.039822	0.045205	0.050550	0.055858	0.061130	0.066366	20
41	0.018004	0.023539	0.029035	0.034493	0.039912	0.045294	0.050638	0.055946	0.061217	0.066453	19
42	0.018096	0.023631	0.029127	0.034584	0.040002	0.045383	0.050727	0.056034	0.061305	0.066540	18
43	0.018189	0.023723	0.029218	0.034674	0.040092	0.045473	0.050816	0.056122	0.061393	0.066627	17
44	0.018281	0.023815	0.029309	0.034765	0.040182	0.045562	0.050905	0.056211	0.061480	0.066714	16
45	0.018374	0.023907	0.029400	0.034855	0.040272	0.045652	0.050993	0.056299	0.061568	0.066801	15
46	0.018467	0.023999	0.029492	0.034946	0.040362	0.045741	0.051082	0.056387	0.061655	0.066888	14
47	0.018559	0.024090	0.029583	0.035037	0.040452	0.045830	0.051171	0.056475	0.061743	0.066974	13
48	0.018652	0.024182	0.029674	0.035127	0.040542	0.045920	0.051260	0.056563	0.061830	0.067061	12
49	0.018744	0.024274	0.029765	0.035218	0.040632	0.046009	0.051348	0.056651	0.061918	0.067148	11
50	0.018837	0.024366	0.029856	0.035308	0.040722	0.046098	0.051437	0.056739	0.062005	0.067235	10
51	0.018929	0.024458	0.029948	0.035399	0.040812	0.046187	0.051526	0.056827	0.062093	0.067322	9
52	0.019021	0.024550	0.030039	0.035489	0.040902	0.046277	0.051614	0.056915	0.062180	0.067409	8
53	0.019114	0.024641	0.030130	0.035580	0.040992	0.046366	0.051703	0.057003	0.062267	0.067496	7
54	0.019206	0.024733	0.030221	0.035670	0.041082	0.046455	0.051792	0.057091	0.062355	0.067583	6
55	0.019299	0.024825	0.030312	0.035761	0.041171	0.046544	0.051880	0.057179	0.062442	0.067669	5
56	0.019391	0.024917	0.030403	0.035851	0.041261	0.046634	0.051969	0.057267	0.062530	0.067756	4
57	0.019484	0.025009	0.030494	0.035942	0.041351	0.046723	0.052057	0.057355	0.062617	0.067843	3
58	0.019576	0.025100	0.030586	0.036032	0.041441	0.046812	0.052146	0.057443	0.062704	0.067930	2
59	0.019668	0.025192	0.030677	0.036123	0.041531	0.046901	0.052235	0.057531	0.062792	0.068017	1
60	0.019761	0.025284	0.030768	0.036213	0.041621	0.046991	0.052323	0.057619	0.062879	0.068103	0
	20 ^m	28 ^m	27 ^m	26 ^m	25 ^m	24 ^m	23 ^m	22 ^m	21 ^m	20 ^m	

Sec.	40°				41°				42°				Sec.
	40 deg.				41 deg.				42 deg.				
0	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0
0	0	0.068103	9.073292	9.078446	9.083565	9.088651	9.093702	9.098720	9.103706	9.108658	9.113579	60	0
1	15	0.068190	0.73378	0.78532	0.83650	0.88735	0.93786	0.98804	1.03788	1.08741	1.13661	59	1
2	30	0.068277	0.73465	0.78617	0.83735	0.88820	0.93870	0.98887	1.03871	1.08823	1.13742	58	2
3	45	0.068364	0.73551	0.78703	0.83820	0.88904	0.93954	0.98970	1.03954	1.08905	1.13824	57	3
4	0	0.068450	0.73637	0.78788	0.83905	0.88988	0.94038	0.99054	9.104037	9.108987	9.113906	56	4
5	15	0.068537	0.73723	0.78874	0.83990	0.89073	0.94122	0.99137	1.04119	1.09070	1.13975	55	5
6	30	0.068624	0.73809	0.78959	0.84075	0.89157	0.94205	0.99220	1.04202	1.09152	1.14069	54	6
7	45	0.068711	0.73895	0.79045	0.84160	0.89242	0.94289	0.99304	1.04285	1.09234	1.14151	53	7
8	0	0.068797	0.73981	0.79131	0.84245	0.89326	0.94373	0.99387	9.104368	9.109316	9.114233	52	8
9	15	0.068884	0.74067	0.79216	0.84330	0.89410	0.94457	0.99470	1.04450	1.09398	1.14314	51	9
10	30	0.068971	0.74154	0.79302	0.84415	0.89495	0.94541	0.99553	1.04533	1.09481	1.14396	50	10
11	45	0.069057	0.74240	0.79387	0.84500	0.89579	0.94625	0.99637	1.04616	1.09563	1.14477	49	11
12	0	0.069144	0.74326	0.79473	0.84585	0.89664	0.94708	0.99720	9.104699	9.109645	9.114559	48	12
13	15	0.069231	0.74412	0.79558	0.84670	0.89748	0.94792	0.99803	1.04781	1.09727	1.14641	47	13
14	30	0.069317	0.74498	0.79644	0.84755	0.89832	0.94876	0.99886	1.04864	1.09809	1.14722	46	14
15	45	0.069404	0.74584	0.79729	0.84840	0.89917	0.94960	0.99970	1.04947	1.09891	1.14804	45	15
16	0	0.069490	0.74670	0.79815	0.84925	0.90001	9.095044	9.100053	9.105030	9.109974	9.114886	44	16
17	15	0.069577	0.74756	0.79900	0.85010	0.90085	0.95127	1.00136	1.05112	1.10056	1.14967	43	17
18	30	0.069664	0.74842	0.79985	0.85094	0.90170	0.95211	1.00219	1.05195	1.10138	1.15049	42	18
19	45	0.069750	0.74928	0.80071	0.85179	0.90254	0.95295	1.00302	1.05277	1.10220	1.15130	41	19
20	0	0.069837	0.75014	0.80156	0.85264	9.090338	9.095379	9.100386	9.105360	9.110302	9.115212	40	20
21	15	0.069923	0.75100	0.80242	0.85349	0.90422	0.95462	1.00469	1.05443	1.10384	1.15293	39	21
22	30	0.070010	0.75186	0.80327	0.85434	0.90507	0.95546	1.00552	1.05525	1.10466	1.15375	38	22
23	45	0.070097	0.75272	0.80412	0.85519	0.90591	0.95630	1.00635	1.05608	1.10548	1.15457	37	23
24	0	0.070183	0.75358	0.80498	0.85604	9.090675	9.095713	9.100718	9.105690	9.110630	9.115538	36	24
25	15	0.070270	0.75444	0.80583	0.85688	0.90759	0.95797	1.00801	1.05773	1.10712	1.15620	35	25
26	30	0.070356	0.75530	0.80669	0.85773	0.90844	0.95881	1.00885	1.05856	1.10794	1.15701	34	26
27	45	0.070443	0.75616	0.80754	0.85858	0.90928	0.95964	1.00968	1.05938	1.10876	1.15783	33	27
28	0	0.070529	0.75702	0.80839	0.85943	9.091012	9.096048	9.101051	9.106021	9.110959	9.115864	32	28
29	15	0.070616	0.75787	0.80925	0.86027	0.91096	0.96132	1.01134	1.06104	1.11041	1.15946	31	29
30	30	0.070702	0.75873	0.81010	0.86112	0.91181	0.96215	1.01217	1.06186	1.11123	1.16027	30	30
31	45	0.070789	0.75959	0.81095	0.86197	0.91265	0.96299	1.01300	1.06268	1.11205	1.16109	29	31
32	0	0.070875	0.76045	0.81181	0.86282	9.091349	9.096383	9.101383	9.106351	9.111287	9.116190	28	32
33	15	0.070962	0.76131	0.81266	0.86366	0.91433	0.96466	1.01466	1.06434	1.11369	1.16272	27	33
34	30	0.071048	0.76217	0.81351	0.86451	0.91517	0.96550	1.01549	1.06516	1.11451	1.16353	26	34
35	45	0.071134	0.76303	0.81436	0.86536	0.91601	0.96633	1.01632	1.06599	1.11532	1.16434	25	35
36	0	0.071221	0.76389	0.81522	0.86621	9.091686	9.096717	9.101715	9.106681	9.111614	9.116516	24	36
37	15	0.071307	0.76474	0.81607	0.86705	0.91770	0.96801	1.01798	1.06764	1.11696	1.16597	23	37
38	30	0.071394	0.76560	0.81692	0.86790	0.91854	0.96884	1.01881	1.06846	1.11778	1.16679	22	38
39	45	0.071480	0.76646	0.81777	0.86875	0.91938	0.96968	1.01964	1.06928	1.11860	1.16760	21	39
40	0	0.071566	0.76732	0.81863	0.86959	9.092022	9.097051	9.102047	9.107011	9.111942	9.116841	20	40
41	15	0.071653	0.76818	0.81948	0.87044	0.92106	0.97135	1.02130	1.07093	1.12024	1.16923	19	41
42	30	0.071739	0.76903	0.82033	0.87129	0.92190	0.97218	1.02213	1.07156	1.12106	1.17004	18	42
43	45	0.071826	0.76989	0.82118	0.87213	0.92274	0.97302	1.02296	1.07238	1.12188	1.17086	17	43
44	0	0.071912	0.77075	0.82204	0.87298	9.092358	9.097385	9.102379	9.107341	9.112270	9.117167	16	44
45	15	0.071998	0.77161	0.82289	0.87382	0.92442	0.97469	1.02462	1.07423	1.12352	1.17248	15	45
46	30	0.072085	0.77247	0.82374	0.87467	0.92526	0.97552	1.02545	1.07506	1.12434	1.17330	14	46
47	45	0.072171	0.77332	0.82459	0.87552	0.92610	0.97636	1.02628	1.07588	1.12515	1.17411	13	47
48	0	0.072257	0.77418	0.82544	0.87636	9.092694	9.097719	9.102711	9.107670	9.112597	9.117492	12	48
49	15	0.072343	0.77504	0.82629	0.87721	0.92779	0.97803	1.02794	1.07753	1.12679	1.17574	11	49
50	30	0.072430	0.77589	0.82715	0.87805	0.92863	0.97886	1.02877	1.07835	1.12761	1.17655	10	50
51	45	0.072516	0.77675	0.82800	0.87890	0.92947	0.97970	1.02960	1.07917	1.12843	1.17736	9	51
52	0	0.072602	0.77761	0.82885	0.87975	9.093031	9.098053	9.103043	9.108000	9.112925	9.117818	8	52
53	15	0.072689	0.77846	0.82970	0.88059	0.93114	0.98137	1.03126	1.08082	1.13006	1.17899	7	53
54	30	0.072775	0.77932	0.83055	0.88144	0.93198	0.98220	1.03209	1.08165	1.13088	1.17980	6	54
55	45	0.072861	0.78018	0.83140	0.88228	0.93282	0.98303	1.03291	1.08247	1.13170	1.18061	5	55
56	0	0.072947	0.78103	0.83225	0.88313	9.093366	9.098387	9.103374	9.108329	9.113252	9.118143	4	56
57	15	0.073033	0.78189	0.83310	0.88397	0.93450	0.98470	1.03457	1.08411	1.13334	1.18224	3	57
58	30	0.073120	0.78275	0.83395	0.88482	0.93534	0.98554	1.03540	1.08494	1.13415	1.18305	2	58
59	45	0.073206	0.78360	0.83480	0.88566	0.93618	0.98637	1.03623	1.08576	1.13497	1.18386	1	59
60	0	0.073292	0.78446	0.83565	0.88651	9.093702	9.098720	9.103706	9.108658	9.113579	9.118468	0	60
Sec.	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	Sec.		

	50 ^m	51 ^m	52 ^m	53 ^m	54 ^m	55 ^m	56 ^m	57 ^m	58 ^m	59 ^m			
	42 deg.					43 deg.							
	42 ^{deg.}	43 ^{deg.}	44 ^{deg.}	45 ^{deg.}	46 ^{deg.}	47 ^{deg.}	48 ^{deg.}	49 ^{deg.}	50 ^{deg.}	51 ^{deg.}			
0	0	9	118468	9.123325	9.128151	9.132946	9.137711	9.142446	9.147151	9.151826	9.156473	9.161090	60
1	15	118549	123405	128231	133026	137790	142524	147229	151904	156550	161167	165759	59
2	30	118630	123486	128311	133106	137869	142603	147307	151982	156627	161244	165858	58
3	45	118711	123567	128391	133185	137948	142682	147385	152059	156704	161320	165937	57
4	0	9.118792	9.123647	9.128472	9.133265	9.138028	9.142760	9.147463	9.152137	9.156781	9.161397	9.165977	56
5	15	118873	123728	128552	133344	138107	142839	147542	152215	156859	161474	166055	55
6	30	118955	123809	128632	133424	138186	142918	147620	152292	156936	161550	166134	54
7	45	119036	123889	128712	133504	138265	142996	147698	152370	157013	161627	166217	53
8	0	9.119117	9.123970	9.128792	9.133583	9.138344	9.143075	9.147776	9.152448	9.157090	9.161704	9.166285	52
9	15	119198	124051	128872	133663	138423	143153	147854	152525	157167	161780	166351	51
10	30	119279	124131	128952	133742	138502	143232	147932	152603	157244	161857	166430	50
11	45	119360	124212	129032	133822	138581	143311	148010	152680	157321	161934	166509	49
12	0	9.119441	9.124292	9.129112	9.133902	9.138660	9.143389	9.148088	9.152758	9.157399	9.162010	9.166594	48
13	15	119523	124373	129192	133981	138739	143468	148166	152836	157476	162087	166677	47
14	30	119604	124454	129273	134061	138819	143546	148244	152913	157553	162164	166756	46
15	45	119685	124534	129353	134140	138898	143625	148322	152991	157630	162240	166835	45
16	0	9.119766	9.124615	9.129433	9.134220	9.138977	9.143703	9.148401	9.153066	9.157707	9.162317	9.166899	44
17	15	119847	124695	129513	134299	139056	143782	148479	153146	157784	162393	167000	43
18	30	119928	124776	129593	134379	139135	143860	148557	153223	157861	162470	167079	42
19	45	120009	124856	129673	134458	139214	143939	148635	153301	157938	162546	167158	41
20	0	9.120090	9.124937	9.129753	9.134538	9.139293	9.144017	9.148713	9.153378	9.158015	9.162623	9.167209	40
21	15	120171	125017	129833	134617	139372	144096	148791	153456	158092	162700	167289	39
22	30	120252	125098	129913	134697	139451	144174	148869	153533	158169	162776	167368	38
23	45	120333	125178	129993	134776	139530	144253	148947	153611	158246	162853	167447	37
24	0	9.120414	9.125259	9.130073	9.134856	9.139609	9.144331	9.149025	9.153688	9.158323	9.162929	9.167506	36
25	15	120495	125339	130153	134935	139687	144410	149103	153766	158400	163006	167583	35
26	30	120576	125420	130233	135015	139766	144488	149180	153843	158477	163082	167660	34
27	45	120657	125500	130312	135094	139845	144567	149258	153921	158554	163159	167737	33
28	0	9.120738	9.125581	9.130392	9.135174	9.139924	9.144645	9.149336	9.153998	9.158631	9.163235	9.167818	32
29	15	120819	125661	130472	135253	140003	144724	149414	154076	158708	163312	167895	31
30	30	120900	125742	130552	135332	140082	144802	149492	154153	158785	163388	167972	30
31	45	120981	125822	130632	135412	140161	144880	149570	154231	158862	163465	168049	29
32	0	9.121062	9.125903	9.130712	9.135491	9.140240	9.144959	9.149648	9.154368	9.158999	9.163651	9.168282	28
33	15	121143	125983	130792	135571	140319	145037	149726	154385	159016	163618	168357	27
34	30	121224	126063	130872	135650	140398	145116	149804	154463	159093	163694	168434	26
35	45	121305	126144	130952	135729	140477	145194	149882	154540	159170	163771	168511	25
36	0	9.121386	9.126224	9.131032	9.135809	9.140556	9.145272	9.149960	9.154618	9.159247	9.163847	9.168424	24
37	15	121467	126304	131112	135888	140634	145351	150038	154695	159324	163923	168500	23
38	30	121547	126385	131191	135967	140713	145429	150115	154772	159401	164000	168577	22
39	45	121628	126465	131271	136047	140792	145507	150193	154850	159477	164076	168654	21
40	0	9.121709	9.126546	9.131351	9.136126	9.140871	9.145586	9.150271	9.154927	9.159554	9.164153	9.168733	20
41	15	121790	126626	131431	136205	140950	145664	150349	155004	159631	164229	168808	19
42	30	121871	126706	131511	136285	141029	145742	150427	155082	159708	164306	168885	18
43	45	121952	126787	131591	136364	141107	145821	150505	155159	159785	164382	168961	17
44	0	9.122033	9.126867	9.131670	9.136443	9.141186	9.145899	9.150582	9.155237	9.159862	9.164458	9.169035	16
45	15	122113	126947	131750	136522	141265	145977	150660	155314	159939	164535	169111	15
46	30	122194	127028	131830	136602	141344	146056	150738	155391	160015	164611	169187	14
47	45	122275	127108	131910	136681	141422	146134	150816	155468	160092	164687	169262	13
48	0	9.122356	9.127188	9.131990	9.136761	9.141501	9.146212	9.150894	9.155546	9.160169	9.164764	9.169340	12
49	15	122437	127268	132069	136840	141580	146290	150971	155623	160246	164840	169416	11
50	30	122517	127349	132149	136919	141659	146369	151049	155700	160323	164916	169491	10
51	45	122598	127429	132229	136998	141737	146447	151127	155778	160399	164993	169567	9
52	0	9.122679	9.127509	9.132309	9.137077	9.141816	9.146525	9.151205	9.155855	9.160476	9.165069	9.169645	8
53	15	122760	127589	132388	137157	141895	146603	151282	155932	160554	165145	169720	7
54	30	122840	127670	132468	137236	141974	146682	151360	156009	160630	165222	169797	6
55	45	122921	127750	132548	137315	142052	146760	151438	156087	160707	165298	169874	5
56	0	9.123002	9.127830	9.132627	9.137394	9.142131	9.146838	9.151516	9.156164	9.160783	9.165374	9.169948	4
57	15	123083	127910	132707	137473	142210	146916	151593	156241	160860	165450	169999	3
58	30	123163	127990	132787	137553	142288	146994	151671	156318	160937	165527	170076	2
59	45	123244	128071	132866	137632	142367	147073	151749	156395	161013	165603	170155	1
60	0	9.123325	9.128151	9.132946	9.137711	9.142446	9.147151	9.151826	9.156473	9.161090	9.165679	9.170250	0
	9 ^m	8 ^m	7 ^m	6 ^m	5 ^m	4 ^m	3 ^m	2 ^m	1 ^m	0 ^m			

		45 deg.				46 deg.				47 deg.					
		0 ^m	1 ^m	2 ^m	3 ^m	4 ^m	5 ^m	6 ^m	7 ^m	8 ^m	9 ^m				
sec.		0'	15'	30'	45'	0'	15'	30'	45'	0'	15'				
0	9.165679	9.170240	9.174773	9.179278	9.183756	9.188207	9.192631	9.197028	9.201399	9.205745	60				
15	165755	170316	174848	179353	183830	188281	192704	197101	201472	205817	59				
30	165832	170392	174924	179428	183905	188355	192778	197174	201545	205895	58				
45	165908	170467	174993	179503	183979	188429	192851	197247	201617	205961	57				
1'	165984	170543	175074	179578	184054	188503	192925	197320	201690	206033	56				
15	166060	170619	175149	179652	184128	188576	192998	197393	201762	206105	55				
30	166137	170695	175225	179727	184202	188650	193072	197466	201835	206178	54				
45	166213	170770	175300	179802	184277	188724	193145	197539	201908	206250	53				
2'	166289	170846	175375	179877	184351	188798	193219	197613	201980	206322	52				
15	166365	170922	175450	179952	184425	188872	193292	197685	202053	206394	51				
30	166441	170998	175526	180026	184500	188946	193366	197759	202125	206466	50				
45	166517	171073	175601	180101	184574	189020	193439	197831	202198	206538	49				
3'	166594	171149	175676	180176	184648	189094	193512	197905	202270	206610	48				
15	166670	171225	175751	180251	184723	189168	193586	197977	202343	206683	47				
30	166746	171300	175827	180325	184797	189241	193659	198050	202416	206755	46				
45	166822	171376	175902	180400	184871	189315	193733	198123	202488	206827	45				
4'	166898	171452	175977	180475	184946	189389	193806	198196	202561	206899	44				
15	166974	171527	176052	180550	185020	189463	193879	198269	202633	206971	43				
30	167051	171603	176127	180624	185094	189537	193953	198342	202706	207043	42				
45	167127	171678	176203	180699	185168	189611	194026	198415	202778	207115	41				
5'	167203	171754	176278	180774	185243	189684	194100	198488	202851	207187	40				
20	167279	171830	176353	180848	185317	189758	194173	198561	202923	207259	39				
30	167355	171905	176428	180923	185391	189832	194246	198634	202996	207331	38				
45	167431	171981	176503	180998	185465	189906	19								

	10 ^m	11 ^m	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m	
	47 deg.					48 deg.					
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	
0	9.210064	9.214358	9.218627	9.222870	9.227089	9.231284	9.235454	9.239600	9.243722	9.247821	60
15	210136	214429	218697	222941	227159	231353	235523	239669	243791	247889	59
30	210207	214501	218768	223011	227229	231423	235593	239738	243859	247957	58
45	210279	214572	218839	223082	227300	231493	235662	239807	243928	248025	57
0	9.210351	9.214643	9.218910	9.223152	9.227370	9.231562	9.235731	9.239876	9.243996	9.248094	56
15	210423	214715	218981	223253	227440	231611	235800	239944	244065	248162	55
30	210494	214786	219052	223293	227510	231702	235870	240013	244133	248230	54
45	210566	214857	219123	223364	227580	231771	235939	240082	244201	248298	53
0	9.210638	9.214929	9.219194	9.223434	9.227650	9.231841	9.236008	9.240151	9.244270	9.248366	52
15	210710	215000	219265	223505	227720	231911	236077	240220	244339	248434	51
30	210781	215071	219336	223575	227790	231980	236147	240289	244407	248502	50
45	210853	215142	219406	223646	227860	232050	236216	240358	244476	248570	49
0	9.210925	9.215214	9.219477	9.223716	9.227930	9.232120	9.236285	9.240426	9.244544	9.248638	48
15	210996	215285	219548	223785	228000	232189	236354	240495	244612	248706	47
30	211068	215356	219619	223857	228070	232259	236423	240564	244681	248774	46
45	211140	215427	219690	223927	228140	232329	236493	240633	244749	248842	45
0	9.211211	9.215499	9.219761	9.223998	9.228210	9.232398	9.236562	9.240702	9.244811	9.248910	44
15	211283	215570	219831	224068	228280	232468	236631	240770	244886	248987	43
30	211355	215641	219902	224139	228350	232537	236700	240839	244954	249064	42
45	211426	215712	219973	224209	228420	232607	236769	240908	245023	249114	41
0	9.211498	9.215784	9.220044	9.224279	9.228490	9.232676	9.236839	9.240977	9.245091	9.249182	40
15	211570	215855	220115	224350	228560	232746	236908	241046	245160	249250	39
30	211641	215926	220186	224420	228630	232816	236977	241114	245228	249318	38
45	211713	215997	220256	224490	228700	232885	237046	241183	245296	249386	37
0	9.211785	9.216068	9.220327	9.224561	9.228770	9.232955	9.237115	9.241252	9.245365	9.249454	36
15	211856	216140	220398	224631	228840	233024	237184	241321	245433	249522	35
30	211928	216211	220469	224702	228910	233094	237254	241389	245501	249590	34
45	211999	216282	220539	224772	228980	233163	237323	241458	245570	249658	33
0	9.212071	9.216353	9.220610	9.224842	9.229050	9.233233	9.237392	9.241527	9.245638	9.249726	32
15	212143	216424	220681	224912	229120	233302	237461	241593	245706	249794	31
30	212214	216495	220752	224983	229190	233372	237530	241664	245775	249863	30
45	212286	216566	220822	225053	229259	233441	237599	241733	245843	249930	29
0	9.212357	9.216638	9.220893	9.225123	9.229329	9.233511	9.237668	9.241802	9.245911	9.249998	28
15	212429	216709	220964	225194	229399	233580	237737	241870	245980	250065	27
30	212500	216780	221034	225264	229469	233650	237806	241939	246048	250133	26
45	212572	216851	221105	225334	229539	233719	237875	242008	246116	250201	25
0	9.212643	9.216922	9.221176	9.225405	9.229609	9.233789	9.237944	9.242076	9.246184	9.250269	24
15	212715	216993	221246	225475	229679	233858	238014	242145	246253	250337	23
30	212786	217064	221317	225545	229749	233928	238083	242214	246321	250405	22
45	212858	217135	221388	225615	229818	233997	238152	242282	246389	250473	21
0	9.212929	9.217206	9.221459	9.225686	9.229888	9.234067	9.238221	9.242351	9.246457	9.250541	20
15	213001	217277	221529	225756	229958	234136	238290	242420	246526	250608	19
30	213072	217349	221600	225826	230028	234205	238359	242488	246594	250676	18
45	213144	217420	221670	225896	230098	234275	238428	242557	246662	250744	17
0	9.213215	9.217491	9.221741	9.225967	9.230168	9.234344	9.238497	9.242625	9.246730	9.250812	16
15	213287	217562	221812	226037	230237	234414	238566	242694	246799	250880	15
30	213358	217633	221882	226107	230307	234483	238635	242763	246867	250948	14
45	213430	217704	221953	226177	230377	234552	238704	242831	246935	251015	13
0	9.213501	9.217775	9.222024	9.226247	9.230447	9.234622	9.238773	9.242900	9.247003	9.251083	12
15	213573	217846	222094	226318	230517	234691	238842	242968	247071	251151	11
30	213644	217917	222165	226388	230586	234761	238911	243037	247140	251219	10
45	213715	217988	222235	226458	230656	234830	238980	243106	247208	251287	9
0	9.213787	9.218059	9.222306	9.226528	9.230726	9.234899	9.239049	9.243174	9.247276	9.251354	8
15	213858	218130	222376	226598	230796	234969	239118	243243	247344	251422	7
30	213930	218201	222447	226668	230865	235038	239187	243311	247412	251490	6
45	214001	218272	222518	226739	230935	235107	239255	243380	247480	251558	5
0	9.214072	9.218343	9.222585	9.226809	9.231005	9.235177	9.239324	9.243448	9.247549	9.251626	4
15	214144	218414	222659	226879	231075	235246	239393	243517	247617	251693	3
30	214215	218485	222729	226949	231144	235315	239462	243585	247685	251761	2
45	214286	218556	222800	227019	231214	235385	239531	243654	247753	251829	1
0	9.214358	9.218627	9.222870	9.227089	9.231284	9.235454	9.239600	9.243722	9.247821	9.251897	0
	49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m	

	20 ^m	21 ^m	22 ^m	23 ^m	24 ^m	25 ^m	26 ^m	27 ^m	28 ^m	29 ^m	
	50 deg.				51 deg.				52 deg.		
SEC.	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	SEC.
0	09.251897	9.255949	9.259978	9.263985	9.267969	9.271930	9.275870	9.279788	9.283684	9.287558	60
15	251964	256016	260045	264051	268035	271996	275936	279853	283749	287623	59
30	252032	256083	260112	264118	268101	272062	276001	279918	283813	287687	58
45	252100	256151	260179	264184	268167	272128	276066	279983	283878	287752	57
60	252167	256218	260246	264251	268234	272194	276132	280048	283943	287816	56
15	252235	256285	260313	264317	268300	272260	276197	280113	284008	287880	55
30	252303	256353	260380	264384	268366	272325	276263	280178	284072	287945	54
45	252370	256420	260447	264451	268432	272391	276328	280243	284137	288009	53
60	252438	256487	260514	264517	268498	272457	276394	280309	284202	288073	52
15	252506	256555	260580	264584	268564	272523	276459	280374	284266	288138	51
30	252573	256622	260647	264650	268631	272589	276525	280439	284331	288202	50
45	252641	256689	260714	264717	268697	272654	276590	280504	284396	288266	49
60	252709	256756	260781	264783	268763	272720	276655	280569	284461	288331	48
15	252776	256824	260848	264850	268829	272786	276721	280634	284525	288395	47
30	252844	256891	260915	264916	268895	272852	276786	280699	284590	288459	46
45	252912	256958	260982	264983	268961	272917	276852	280764	284654	288524	45
60	252979	257025	261049	265049	269027	272983	276917	280829	284719	288588	44
15	253047	257093	261115	265116	269093	273049	276982	280894	284784	288652	43
30	253115	257160	261182	265182	269160	273115	277048	280959	284849	288717	42
45	253182	257227	261249	265249	269226	273180	277113	281024	284913	288781	41
60	253250	257294	261316	265315	269292	273246	277178	281089	284978	288845	40
15	253317	257362	261383	265382	269358	273312	277244	281154	285042	288909	39
30	253385	257429	261450	265448	269424	273378	277309	281219	285107	288974	38
45	253453	257496	261517	265514	269490	273443	277374	281284	285172	289038	37
60	253520	257563	261583	265581	269556	273509	277440	281349	285236	289102	36
15	253588	257630	261650	265647	269622	273575	277505	281414	285301	289166	35
30	253655	257698	261717	265714	269688	273640	277570	281479	285366	289231	34
45	253723	257765	261784	265780	269754	273706	277636	281544	285430	289295	33
60	253790	257832	261851	265847	269820	273772	277701	281609	285495	289359	32
15	253858	257899	261917	265913	269886	273837	277766	281674	285559	289423	31
30	253926	257966	261984	265979	269952	273903	277832	281739	285624	289488	30
45	253993	258033	262051	266046	270018	273969	277897	281803	285688	289552	29
60	254061	258101	262118	266112	270084	274034	277962	281868	285753	289616	28
15	254128	258168	262184	266179	270150	274100	278028	281933	285817	289680	27
30	254196	258235	262251	266245	270216	274166	278093	281998	285882	289745	26
45	254263	258302	262318	266311	270282	274231	278158	282063	285947	289809	25
60	254331	258369	262385	266378	270348	274297	278223	282128	286011	289873	24
15	254398	258436	262451	266444	270414	274362	278289	282193	286076	289937	23
30	254466	258503	262518	266510	270480	274428	278354	282258	286140	290001	22
45	254533	258570	262585	266577	270546	274494	278419	282323	286205	290065	21
60	254601	258637	262652	266643	270612	274559	278484	282388	286269	290130	20
15	254666	258705	262718	266709	270678	274625	278550	282452	286334	290194	19
30	254735	258772	262785	266776	270744	274691	278615	282517	286398	290258	18
45	254803	258839	262852	266842	270810	274756	278680	282582	286463	290322	17
60	254870	258906	262918	266908	270876	274822	278745	282647	286527	290386	16
15	254938	258973	262985	266975	270942	274887	278810	282712	286592	290450	15
30	255005	259040	263052	267041	271008	274953	278876	282777	286656	290514	14
45	255073	259107	263118	267107	271074	275018	278941	282842	286721	290579	13
60	255140	259174	263185	267174	271140	275084	279006	282906	286785	290643	12
15	255207	259241	263252	267240	271206	275149	279071	282971	286850	290707	11
30	255275	259308	263318	267306	271272	275215	279136	283036	286914	290771	10
45	255342	259375	263385	267372	271338	275281	279202	283101	286979	290835	9
60	255410	259442	263452	267439	271404	275346	279267	283166	287043	290899	8
15	255477	259509	263518	267505	271469	275412	279332	283230	287107	290963	7
30	255545	259576	263585	267571	271535	275477	279397	283295	287172	291027	6
45	255612	259643	263652	267638	271601	275543	279462	283360	287236	291091	5
60	255679	259710	263718	267704	271667	275608	279527	283425	287301	291155	4
15	255747	259777	263785	267770	271733	275674	279592	283490	287365	291219	3
30	255814	259844	263851	267836	271799	275739	279658	283554	287430	291284	2
45	255881	259911	263918	267902	271865	275805	279723	283619	287494	291348	1
60	255949	259978	263985	267969	271930	275870	279788	283684	287558	291412	0
	39 ^m	38 ^m	37 ^m	36 ^m	35 ^m	34 ^m	33 ^m	32 ^m	31 ^m	30 ^m	

SEC.	30 ^m		31 ^m	32 ^m		33 ^m	34 ^m	35 ^m	36 ^m		37 ^m	38 ^m	39 ^m	SEC.
	52 deg.			53 deg.					54 deg.					
0	30'	45'		0'	15'	30'	45'		0'	15'	30'	45'		
1	5	9.291412	9.295244	9.299055	9.302845	9.306615	9.310364	9.314094	9.317803	9.321492	9.325161	9.328811	60	
15		291476	295307	299118	302908	306678	310427	314155	317864	321553	325222	328871	59	
230		291540	295371	299182	302971	306740	310489	314217	317926	321614	325283	328932	58	
345		291604	295435	299243	303034	306803	310551	314279	317987	321676	325344	328993	57	
4	31'	46'		1'	16'	31'	46'		1'	16'	31'	46'		
4	0	9.291668	9.295498	9.299338	9.303097	9.306866	9.310614	9.314341	9.318049	9.321737	9.325405	9.329054	56	
5	15	291732	295562	299372	303160	306928	310676	314403	318111	321798	325466	329115	55	
6	30	291796	295626	299435	303223	306991	310738	314465	318172	321860	325527	329176	54	
745		291860	295689	299498	303286	307053	310800	314527	318234	321921	325588	329237	53	
8	33'	47'		2'	17'	33'	47'		2'	17'	33'	47'		
8	0	9.291924	9.295753	9.299561	9.303349	9.307116	9.310863	9.314589	9.318296	9.321982	9.325649	9.329298	52	
9	15	291988	295817	299625	303412	307179	310925	314651	318357	322043	325710	329359	51	
10	30	292052	295880	299688	303475	307241	310987	314713	318419	322105	325771	329420	50	
1145		292116	295944	299751	303538	307304	311050	314775	318480	322166	325832	329489	49	
12	33'	48'		3'	18'	33'	48'		3'	18'	33'	48'		
12	0	9.292180	9.296008	9.299815	9.303601	9.307367	9.311112	9.314837	9.318542	9.322227	9.325893	9.329548	48	
13	15	292244	296071	299878	303664	307429	311174	314899	318604	322288	325954	329609	47	
14	30	292308	296135	299941	303727	307492	311236	314961	318665	322350	326015	329670	46	
1545		292372	296198	300004	303790	307554	311299	315023	318727	322411	326076	329731	45	
16	34'	49'		4'	19'	34'	49'		4'	19'	34'	49'		
16	0	9.292436	9.296262	9.300068	9.303853	9.307617	9.311361	9.315085	9.318788	9.322472	9.326136	9.329790	44	
17	15	292499	296326	300131	303915	307679	311423	315146	318850	322533	326197	329851	43	
18	30	292564	296389	300194	303978	307742	311485	315208	318911	322595	326258	329912	42	
1945		292627	296453	300257	304041	307804	311547	315270	318973	322656	326319	329974	41	
20	35'	50'		5'	20'	35'	50'		5'	20'	35'	50'		
20	0	9.292691	9.296516	9.300321	9.304104	9.307867	9.311610	9.315332	9.319035	9.322717	9.326380	9.329933	40	
21	15	292755	296580	300384	304167	307930	311672	315394	319096	322778	326441	329994	39	
22	30	292819	296644	300447	304230	307992	311734	315456	319158	322840	326502	329955	38	
2345		292884	296707	300510	304293	308055	311796	315518	319219	322901	326563	329924	37	
24	36'	51'		6'	21'	36'	51'		6'	21'	36'	51'		
24	0	9.292947	9.296771	9.300574	9.304356	9.308117	9.311858	9.315580	9.319281	9.322962	9.326624	9.329275	36	
25	15	293011	296834	300637	304418	308180	311921	315641	319342	323023	326684	329335	35	
26	30	293075	296898	300700	304481	308242	311983	315703	319404	323084	326745	329396	34	
2745		293139	296961	300763	304544	308305	312045	315765	319465	323145	326806	329457	33	
28	37'	52'		7'	22'	37'	52'		7'	22'	37'	52'		
28	0	9.293203	9.297023	9.300826	9.304607	9.308367	9.312107	9.315827	9.319527	9.323207	9.326867	9.329517	32	
29	15	293266	297088	300889	304670	308430	312169	315889	319588	323268	326928	329578	31	
30	30	293330	297152	300953	304733	308492	312231	315951	319650	323329	326989	329639	30	
3145		293394	297215	301016	304796	308555	312294	316012	319711	323390	327049	329699	29	
32	38'	53'		8'	23'	38'	53'		8'	23'	38'	53'		
32	0	9.293458	9.297279	9.301079	9.304858	9.308617	9.312356	9.316074	9.319773	9.323451	9.327110	9.329769	28	
33	15	293522	297342	301142	304921	308680	312418	316136	319833	323512	327171	9.329828	27	
34	30	293586	297406	301205	304984	308742	312480	316198	319896	323574	327232	9.329892	26	
3545		293650	297469	301268	305047	308805	312542	316260	319957	323635	327293	9.329956	25	
36	39'	54'		9'	24'	39'	54'		9'	24'	39'	54'		
36	0	9.293713	9.297533	9.301332	9.305110	9.308867	9.312604	9.316321	9.320019	9.323696	9.327354	9.329012	24	
37	15	293777	297596	301395	305172	308929	312666	316383	320180	323857	327515	9.329076	23	
38	30	293841	297660	301458	305235	308992	312729	316445	320141	323818	327475	9.329140	22	
3945		293905	297723	301521	305298	309054	312791	316507	320203	323879	327536	9.329204	21	
40	40'	55'		10'	25'	40'	55'		10'	25'	40'	55'		
40	0	9.293969	9.297787	9.301584	9.305361	9.309117	9.312853	9.316568	9.320264	9.323940	9.327597	9.329254	20	
41	15	294032	297850	301647	305423	309179	312915	316630	320326	324001	327657	9.329318	19	
42	30	294096	297914	301710	305486	309242	312977	316692	320387	324062	327718	9.329382	18	
4345		294160	297977	301773	305549	309304	313039	316754	320448	324124	327779	9.329446	17	
44	41'	56'		11'	26'	41'	56'		11'	26'	41'	56'		
44	0	9.294224	9.298041	9.301836	9.305612	9.309367	9.313101	9.316815	9.320510	9.324185	9.327840	9.329495	16	
45	15	294288	298104	301900	305674	309429	313163	316877	320571	324246	327900	9.329559	15	
46	30	294351	298167	301963	305737	309491	313225	316939	320633	324307	327961	9.329623	14	
4745		294415	298231	302026	305800	309554	313287	317000	320694	324368	328022	9.329687	13	
48	42'	57'		12'	27'	42'	57'		12'	27'	42'	57'		
48	0	9.294479	9.298294	9.302089	9.305863	9.309616	9.313349	9.317062	9.320756	9.324429	9.328083	9.329737	12	
49	15	294543	298358	302152	305925	309678	313411	317124	320817	324490	328143	9.329801	11	
50	30	294607	298421	302215	305988	309741	313473	317186	320878	324551	328204	9.329865	10	
5145		294670	298485	302278	306051	309803	313535	317247	320940	324612	328265	9.329929	9	
52	43'	58'		13'	28'	43'	58'		13'	28'	43'	58'		
52	0	9.294734	9.298548	9.302341	9.306114	9.309866	9.313597	9.317309	9.321001	9.324673	9.328326	9.329990	8	
53	15	294798	298611	302404	306176	309928	313659	317371	321062	324734	328386	9.329954	7	
54	30	294861	298675	302467	306239	309990	313722	317433	321124	324795	328447	9.329918	6	
5545		294925	298738	302530	306302	310053	313783	317494	321185	324856	328508	9.329982	5	
56	44'	59'		14'	29'	44'	59'		14'	29'	44'	59'		
56	0	9.294989	9.298801	9.302593	9.306364	9.310115	9.313846	9.317556	9.321216	9.324917	9.328568	9.329942	4	
57	15	295053	298865	302556	306427	310177	313907	317618	321308	324978	328629	9.329906	3	
58	30	295116	298928	302619	306490	310240	313970	317679	321369	325039	328690	9.329970	2	
5945		295180	298992	302682	306552	310302	314031	317741	321430	325100	328750	9.329934	1	
60	45'	295244	299055	302745	306615	310364	314094	317803	321492	325161	328811	9.329998	0	
SEC.	29 ^m	28 ^m	27 ^m	26 ^m	25 ^m	24 ^m	23 ^m	22 ^m	21 ^m	20 ^m	SEC.			

		40 ^m	41 ^m	42 ^m	43 ^m	44 ^m	45 ^m	46 ^m	47 ^m	48 ^m	49 ^m
		55 deg.				56 deg.				57 deg.	
°	'	0 9.328811	15 9.332442	30 9.336053	45 9.339645	0 9.343219	15 9.346773	30 9.350309	45 9.353827	0 9.357326	15 9.360807
1	15	328872	332502	336113	339705	343278	346832	350368	353885	357384	360865
2	30	328933	332562	336173	339765	343337	346891	350427	353944	357442	360923
3	45	328993	332623	336233	339824	343397	346950	350485	354002	357500	360980
4	0	1 9.329054	16 9.332683	31 9.336293	46 9.339884	1 9.343456	16 9.347009	31 9.350544	46 9.354060	1 9.357558	16 9.361038
5	15	329114	332743	336353	339944	343515	347068	350603	354119	357617	361096
6	30	329175	332804	336413	340003	343575	347128	350662	354177	357675	361154
7	45	329236	332864	336473	340063	343634	347187	350720	354236	357733	361212
8	0	2 9.329296	17 9.332924	32 9.336533	47 9.340123	2 9.343694	17 9.347246	32 9.350779	47 9.354294	2 9.357791	17 9.361270
9	15	329357	332985	336593	340182	343753	347305	350838	354353	357849	361327
10	30	329418	333045	336653	340242	343812	347364	350897	354411	357907	361385
11	45	329478	333105	336713	340302	343872	347423	350955	354469	357965	361443
12	0	3 9.329539	18 9.333166	33 9.336773	48 9.340361	3 9.343931	18 9.347482	33 9.351014	48 9.354528	3 9.358023	18 9.361501
13	15	329599	333226	336833	340421	343990	347541	351073	354586	358081	361559
14	30	329660	333286	336893	340481	344050	347600	351131	354645	358140	361616
15	45	329721	333346	336953	340540	344109	347659	351190	354703	358198	361674
16	0	4 9.329781	19 9.333407	34 9.337013	49 9.340600	4 9.344168	19 9.347718	34 9.351249	49 9.354762	4 9.358256	19 9.361732
17	15	329842	333467	337073	340660	344228	347777	351308	354820	358314	361790
18	30	329902	333527	337133	340719	344287	347836	351366	354878	358372	361848
19	45	329963	333587	337193	340779	344346	347895	351425	354937	358430	361905
20	0	5 9.330024	20 9.333648	35 9.337253	50 9.340838	5 9.344406	20 9.347954	35 9.351484	50 9.354995	5 9.358488	20 9.361963
21	15	330084	333708	337312	340898	344465	348013	351542	355053	358546	362021
22	30	330145	333768	337372	340958	344524	348072	351601	355112	358604	362079
23	45	330205	333828	337432	341017	344583	348131	351660	355170	358662	362136
24	0	6 9.330266	21 9.333889	36 9.337492	51 9.341077	6 9.344643	21 9.348190	36 9.351718	51 9.355287	6 9.358778	21 9.362252
25	15	330326	333949	337552	341136	344702	348249	351777	355287	358778	362295
26	30	330387	334009	337612	341196	344761	348308	351836	355345	358836	362310
27	45	330447	334069	337672	341256	344820	348367	351894	355403	358894	362367
28	0	7 9.330508	22 9.334129	37 9.337732	52 9.341315	7 9.344880	22 9.348426	37 9.351953	52 9.355462	7 9.358953	22 9.362425
29	15	330568	334190	337792	341375	344939	348484	352011	355520	359010	362482
30	30	330629	334250	337852	341434	344998	348543	352070	355578	359069	362541
31	45	330689	334310	337911	341494	345057	348602	352129	355637	359127	362598
32	0	8 9.330750	23 9.334370	38 9.337971	53 9.341553	8 9.345117	23 9.348661	38 9.352187	53 9.355695	8 9.359185	23 9.362656
33	15	330810	334430	338031	341613	345176	348720	352246	355753	359243	362714
34	30	330871	334490	338091	341672	345235	348779	352305	355812	359301	362771
35	45	330931	334551	338151	341732	345294	348838	352363	355870	359359	362829
36	0	9 9.330992	24 9.334611	39 9.338211	54 9.341792	9 9.345354	24 9.348897	39 9.352422	54 9.355928	9 9.359417	24 9.362887
37	15	331052	334671	338270	341851	345413	348956	352480	355987	359475	362944
38	30	331113	334731	338330	341911	345472	349015	352539	356045	359533	363002
39	45	331173	334791	338390	341970	345531	349074	352597	356103	359590	363060
40	0	10 9.331234	25 9.334851	40 9.338450	55 9.342030	10 9.345590	25 9.349133	40 9.352656	55 9.356161	10 9.359649	25 9.363118
41	15	331294	334912	338510	342089	345649	349191	352715	356220	359706	363175
42	30	331355	334972	338570	342149	345709	349250	352773	356278	359764	363233
43	45	331415	335032	338629	342208	345768	349309	352832	356336	359822	363290
44	0	11 9.331475	26 9.335092	41 9.338689	56 9.342268	11 9.345827	26 9.349368	41 9.352890	56 9.356394	11 9.359880	26 9.363348
45	15	331536	335152	338749	342327	345886	349427	352949	356453	359938	363406
46	30	331596	335212	338809	342386	345945	349486	353007	356511	359996	363463
47	45	331657	335272	338869	342446	346005	349544	353066	356569	360054	363521
48	0	12 9.331717	27 9.335332	42 9.338928	57 9.342505	12 9.346064	27 9.349603	42 9.353125	57 9.356627	12 9.360112	27 9.363579
49	15	331778	335392	338988	342565	346123	349662	353183	356686	360170	363636
50	30	331838	335452	339048	342624	346182	349721	353242	356744	360228	363694
51	45	331898	335513	339108	342684	346241	349780	353300	356802	360286	363752
52	0	13 9.331959	28 9.335573	43 9.339167	58 9.342743	13 9.346300	28 9.349839	43 9.353359	58 9.356860	13 9.360344	28 9.363809
53	15	332019	335633	339227	342803	346359	349897	353417	356918	360402	363867
54	30	332080	335693	339287	342862	346419	349956	353476	356977	360460	363924
55	45	332140	335753	339347	342921	346478	350015	353534	357035	360517	363982
56	0	14 9.332200	29 9.335813	44 9.339406	59 9.342981	14 9.346537	29 9.350074	44 9.353593	59 9.357093	14 9.360575	29 9.364040
57	15	332261	335873	339466	343040	346596	350133	353651	357151	360633	364097
58	30	332321	335933	339526	343100	346655	350192	353710	357209	360691	364155
59	45	332381	335993	339586	343159	346714	350250	353768	357268	360749	364212
60	0	15 9.332442	30 9.336053	45 9.339645	60 9.343219	15 9.346773	30 9.350309	45 9.353827	60 9.357326	15 9.360807	30 9.364270
		19 ^m	18 ^m	17 ^m	16 ^m	15 ^m	14 ^m	13 ^m	12 ^m	11 ^m	10 ^m

	50 ^m	51 ^m	52 ^m	53 ^m	54 ^m	55 ^m	56 ^m	57 ^m	58 ^m	59 ^m	
	57 deg.		58 deg.				59 deg.				
N.P.C.	0'	30'	0'	15'	30'	45'	0'	15'	30'	45'	N.P.C.
0	9.364270	9.367715	9.371142	9.374552	9.377945	9.381320	9.384678	9.388018	9.391342	9.394650	60
15	364327	367772	371199	374609	378001	381376	384733	388074	391398	394704	59
20	364385	367830	371256	374666	378057	381432	384789	388130	391453	394759	58
30	364443	367887	371313	374722	378114	381488	384845	388185	391508	394814	57
35	31'	46'	1'	16'	31'	46'	1'	16'	31'	46'	
40	9.364500	9.367944	9.371370	9.374779	9.378170	9.381544	9.384901	9.388241	9.391563	9.394869	56
50	364558	368001	371427	374836	378227	381600	384957	388296	391619	394924	55
60	364615	368059	371484	374892	378283	381656	385012	388352	391674	394979	54
70	364673	368116	371541	374949	378339	381712	385068	388407	391729	395034	53
75	32'	47'	2'	17'	32'	47'	2'	17'	32'	47'	
80	9.364730	9.368173	9.371598	9.375006	9.378396	9.381768	9.385124	9.388463	9.391784	9.395089	52
90	364788	368230	371655	375062	378452	381824	385180	388518	391839	395144	51
100	364845	368287	371712	375119	378508	381881	385236	388574	391895	395199	50
110	364903	368345	371769	375176	378565	381937	385291	388629	391950	395254	49
115	33'	48'	3'	18'	33'	48'	3'	18'	33'	48'	
120	9.364960	9.368402	9.371826	9.375232	9.378621	9.381993	9.385347	9.388685	9.392005	9.395309	48
130	365018	368459	371883	375289	378677	382049	385403	388740	392060	395364	47
140	365075	368516	371940	375345	378734	382105	385459	388796	392116	395419	46
150	365133	368574	371997	375402	378790	382161	385514	388851	392171	395474	45
155	34'	49'	4'	19'	34'	49'	4'	19'	34'	49'	
160	9.365190	9.368631	9.372053	9.375459	9.378846	9.382217	9.385570	9.388907	9.392226	9.395529	44
170	365248	368688	372110	375515	378903	382273	385626	388962	392281	395583	43
180	365305	368745	372167	375572	378959	382329	385682	389017	392336	395638	42
190	365363	368802	372224	375628	379015	382385	385737	389073	392391	395693	41
195	35'	50'	5'	20'	35'	50'	5'	20'	35'	50'	
200	9.365420	9.368859	9.372281	9.375685	9.379072	9.382441	9.385793	9.389128	9.392447	9.395748	40
210	365478	368917	372338	375742	379128	382497	385849	389184	392502	395803	39
220	365535	368974	372395	375798	379184	382553	385905	389239	392557	395858	38
230	365593	369031	372452	375855	379240	382609	385960	389295	392612	395913	37
235	36'	51'	6'	21'	36'	51'	6'	21'	36'	51'	
240	9.365650	9.369088	9.372508	9.375911	9.379297	9.382665	9.386016	9.389350	9.392667	9.395968	36
250	365707	369145	372565	375968	379353	382721	386072	389405	392722	396023	35
260	365765	369202	372622	376024	379409	382777	386127	389461	392778	396077	34
270	365822	369260	372679	376081	379466	382833	386183	389516	392833	396132	33
275	37'	52'	7'	22'	37'	52'	7'	22'	37'	52'	
280	9.365880	9.369317	9.372736	9.376138	9.379522	9.382889	9.386239	9.389572	9.392888	9.396187	32
290	365937	369374	372793	376194	379578	382945	386294	389627	392943	396242	31
300	365995	369431	372850	376251	379634	383001	386350	389683	392998	396297	30
310	366052	369488	372906	376307	379691	383057	386408	389738	393053	396352	29
315	38'	53'	8'	23'	38'	53'	8'	23'	38'	53'	
320	9.366110	9.369545	9.372963	9.376364	9.379747	9.383113	9.386462	9.389793	9.393108	9.396407	28
330	366167	369602	373020	376420	379803	383169	386517	389849	393163	396461	27
340	366224	369659	373077	376478	379859	383225	386573	389904	393219	396516	26
350	366282	369717	373134	376533	379916	383281	386628	389959	393274	396571	25
355	39'	54'	9'	24'	39'	54'	9'	24'	39'	54'	
360	9.366339	9.369774	9.373190	9.376590	9.379972	9.383337	9.386684	9.390015	9.393329	9.396626	24
370	366396	369831	373247	376646	380028	383392	386740	390070	393384	396681	23
380	366454	369888	373304	376703	380084	383448	386795	390126	393439	396735	22
390	366511	369945	373361	376759	380140	383504	386851	390181	393494	396790	21
395	40'	55'	10'	25'	40'	55'	10'	25'	40'	55'	
400	9.366569	9.370002	9.373418	9.376816	9.380197	9.383560	9.386907	9.390236	9.393549	9.396845	20
410	366626	370059	373474	376872	380253	383616	386962	390292	393604	396900	19
420	366683	370116	373531	376929	380309	383672	387018	390347	393659	396955	18
430	366741	370173	373588	376985	380365	383728	387074	390402	393714	397009	17
435	41'	56'	11'	26'	41'	56'	11'	26'	41'	56'	
440	9.366798	9.370230	9.373645	9.377042	9.380421	9.383784	9.387129	9.390458	9.393769	9.397064	16
450	366855	370287	373701	377098	380478	383840	387185	390513	393824	397119	15
460	366913	370344	373758	377155	380534	383896	387240	390568	393879	397174	14
470	366970	370401	373815	377211	380590	383951	387296	390624	393934	397228	13
475	42'	57'	12'	27'	42'	57'	12'	27'	42'	57'	
480	9.367027	9.370458	9.373872	9.377268	9.380646	9.384007	9.387352	9.390679	9.393989	9.397283	12
490	367085	370515	373928	377324	380702	384063	387407	390734	394044	397338	11
500	367142	370572	373985	377380	380758	384119	387463	390790	394100	397393	10
510	367199	370629	374042	377437	380815	384175	387518	390845	394154	397447	9
515	43'	58'	13'	28'	43'	58'	13'	28'	43'	58'	
520	9.367257	9.370686	9.374099	9.377493	9.380871	9.384231	9.387574	9.390900	9.394210	9.397502	8
530	367314	370744	374155	377550	380927	384287	387630	390955	394265	397557	7
540	367371	370801	374212	377606	380983	384343	387685	391011	394320	397612	6
550	367429	370858	374269	377663	381039	384398	387741	391066	394375	397666	5
555	44'	59'	14'	29'	44'	59'	14'	29'	44'	59'	
560	9.367486	9.370915	9.374326	9.377719	9.381095	9.384454	9.387796	9.391121	9.394430	9.397721	4
570	367543	370972	374382	377775	381151	384510	387852	391177	394485	397776	3
580	367600	371028	374439	377832	381208	384566	387907	391232	394540	397831	2
590	367658	371085	374496	377888	381264	384622	387963	391287	394594	397885	1
600	9.367715	9.371142	9.374552	9.377945	9.381320	9.384678	9.388018	9.391342	9.394650	9.397940	0
	9 ^m	8 ^m	7 ^m	6 ^m	5 ^m	4 ^m	3 ^m	2 ^m	1 ^m	0 ^m	

		0 ^m		1 ^m		2 ^m		3 ^m		4 ^m		5 ^m		6 ^m		7 ^m		8 ^m		9 ^m							
		60 deg.								61 deg.								62 deg.									
		0'		15'		30'		45'		0'		15'		30'		45'		0'		15'		30'					
0	0	9.397940	9.401214	9.404471	9.407713	9.410938	9.414147	9.417340	9.420517	9.423679	9.426825	60															
1	15	397995	401268	404526	407767	410991	414200	417393	420570	423731	426877	59															
2	30	398049	401323	404580	407820	411045	414253	417446	420623	423784	426928	58															
3	45	398104	401377	404634	407874	411099	414307	417499	420675	423836	426981	57															
4	0	9.398159	9.401432	9.404688	9.407928	9.411152	9.414360	9.417552	9.420728	9.423889	9.427034	56															
5	15	398213	401486	404742	407982	411206	414413	417605	420781	423941	427086	55															
6	30	398268	401540	404796	408036	411259	414467	417658	420834	423994	427138	54															
7	45	398323	401595	404850	408090	411313	414520	417711	420887	424046	427191	53															
8	0	9.398377	9.401649	9.404905	9.408144	9.411367	9.414573	9.417764	9.420940	9.424099	9.427243	52															
9	15	398432	401704	404959	408197	411420	414627	417817	420992	424151	427295	51															
10	30	398487	401758	405013	408251	411474	414680	417870	421045	424204	427347	50															
11	45	398541	401812	405067	408305	411527	414733	417923	421098	424256	427390	49															
12	0	9.398596	9.401867	9.405121	9.408359	9.411581	9.414787	9.417977	9.421151	9.424309	9.427452	48															
13	15	398651	401921	405175	408413	411634	414840	418030	421203	424362	427504	47															
14	30	398705	401975	405229	408467	411688	414893	418083	421256	424414	427556	46															
15	45	398760	402030	405283	408520	411741	414946	418136	421309	424467	427609	45															
16	0	9.398815	9.402084	9.405337	9.408574	9.411795	9.415000	9.418189	9.421362	9.424519	9.427661	44															
17	15	398869	402139	405391	408628	411849	415053	418242	421414	424572	427713	43															
18	30	398924	402193	405446	408682	411902	415106	418295	421467	424624	427765	42															
19	45	398978	402247	405500	408736	411956	415160	418348	421520	424676	427818																

		10 ^m	11 ^m	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m			
		62 deg.			63 deg.			64 deg.						
sec.		0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	sec.
0	0	9.429955	9.433070	9.436170	9.439255	9.442325	9.445379	9.448419	9.451445	9.454455	9.457451	60		
1	15	430007	433122	436222	439306	442376	445430	448470	451495	454505	457501	59		
2	30	430059	433174	436273	439358	442427	445481	448520	451545	454555	457551	58		
3	45	430111	433226	436325	439409	442478	445532	448571	451595	454605	457601	57		
4	0	9.431631	9.433277	9.436376	9.439460	9.442529	9.445583	9.448622	9.451646	9.454655	9.457651	56		
5	15	430215	433329	436428	439511	442580	445633	448672	451696	454705	457700	55		
6	30	430267	433381	436479	439563	442631	445684	448723	451746	454756	457750	54		
7	45	430319	433433	436531	439614	442682	445735	448773	451797	454805	457800	53		
8	0	9.433071	9.433485	9.436582	9.439665	9.442733	9.445786	9.448824	9.451847	9.454856	9.457850	52		
9	15	430423	433536	436634	439716	442784	445836	448874	451897	454906	457899	51		
10	30	430475	433588	436685	439768	442835	445887	448925	451947	454956	457949	50		
11	45	430527	433640	436737	439819	442886	445938	448975	451998	455006	457999	49		
12	0	9.435079	9.433692	9.436788	9.439870	9.442937	9.445989	9.449026	9.452048	9.455056	9.458049	48		
13	15	430631	433743	436840	439921	442988	446039	449076	452098	455106	458099	47		
14	30	430683	433795	436891	439973	443039	446090	449127	452148	455156	458148	46		
15	45	430735	433847	436943	440024	443090	446141	449177	452199	455206	458198	45		
16	0	9.430787	9.433898	9.436994	9.440075	9.443141	9.446192	9.449228	9.452249	9.455256	9.458248	44		
17	15	430839	433950	437046	440126	443192	446242	449278	452299	455306	458298	43		
18	30	430891	434002	437097	440177	443243	446293	449329	452349	455356	458347	42		
19	45	430943	434054	437149	440229	443294	446344	449379	452400	455406	458397	41		
20	0	9.430995	9.434105	9.437200	9.440280	9.443345	9.446394	9.449429	9.452450	9.455456	9.458447	40		
21	15	431047	434157	437252	440331	443396	446445	449480	452500	455506	458497	39		
22	30	431099	434209	437303	440382	443446	446496	449530	452550	455556	458546	38		
23	45	431151	434260	437354	440433	443497	446547	449581	452600	455605	458596	37		
24	0	9.431203	9.434312	9.437406	9.440485	9.443548	9.446597	9.449631	9.452651	9.455655	9.458646	36		
25	15	431255	434364	437457	440536	443599	446648	449682	452701	455705	458695	35		
26	30	431307	434415	437509	440587	443650	446699	449732	452751	455755	458745	34		
27	45	431359	434467	437560	440638	443701	446749	449783	452801	455805	458795	33		
28	0	9.431411	9.434519	9.437612	9.440689	9.443752	9.446800	9.449833	9.452851	9.455855	9.458845	32		
29	15	431463	434570	437663	440741	443803	446851	449883	452902	455905	458894	31		
30	30	431515	434622	437714	440792	443854	446901	449934	452952	455955	458944	30		
31	45	431567	434674	437766	440843	443905	446952	449984	453002	456005	458994	29		
32	0	9.431618	9.434725	9.437817	9.440894	9.443956	9.447003	9.450035	9.453052	9.456055	9.459043	28		
33	15	431670	434777	437869	440945	444007	447053	450085	453102	456105	459093	27		
34	30	431722	434829	437920	440996	444058	447104	450136	453152	456155	459143	26		
35	45	431774	434880	437971	441047	444108	447155	450186	453203	456205	459192	25		
36	0	9.431826	9.434932	9.438023	9.441099	9.444159	9.447205	9.450236	9.453253	9.456255	9.459242	24		
37	15	431878	434984	438074	441150	444200	447256	450287	453303	456305	459292	23		
38	30	431930	435035	438126	441201	444261	447306	450337	453353	456354	459341	22		
39	45	431982	435087	438177	441252	444312	447357	450387	453403	456404	459391	21		
40	0	9.432034	9.435139	9.438228	9.441303	9.444363	9.447408	9.450438	9.453453	9.456454	9.459441	20		
41	15	432085	435190	438280	441354	444414	447458	450488	453503	456505	459490	19		
42	30	432137	435242	438331	441405	444465	447509	450539	453554	456554	459540	18		
43	45	432189	435293	438382	441456	444515	447560	450589	453604	456604	459590	17		
44	0	9.432241	9.435345	9.438434	9.441508	9.444566	9.447610	9.450639	9.453654	9.456654	9.459639	16		
45	15	432293	435397	438485	441559	444617	447661	450690	453704	456704	459689	15		
46	30	432345	435448	438537	441610	444668	447711	450740	453750	456754	459739	14		
47	45	432397	435500	438588	441661	444719	447762	450790	453804	456803	459788	13		
48	0	9.432449	9.435551	9.438639	9.441712	9.444770	9.447813	9.450841	9.453854	9.456853	9.459838	12		
49	15	432500	435603	438691	441763	444821	447863	450891	453904	456903	459893	11		
50	30	432552	435655	438742	441814	444871	447914	450941	453955	456953	459937	10		
51	45	432604	435706	438793	441865	444922	447964	450992	454005	457003	459987	9		
52	0	9.432656	9.435758	9.438845	9.441916	9.444973	9.448015	9.451042	9.454055	9.457053	9.460036	8		
53	15	432708	435809	438896	441967	445024	448065	451092	454105	457102	460086	7		
54	30	432759	435861	438947	442018	445075	448116	451143	454155	457152	460136	6		
55	45	432811	435912	438998	442069	445125	448167	451193	454205	457202	460185	5		
56	0	9.432863	9.435964	9.439050	9.442120	9.445176	9.448217	9.451243	9.454255	9.457252	9.460235	4		
57	15	432915	436016	439101	442172	445227	448268	451294	454305	457302	460284	3		
58	30	432967	436067	439152	442223	445278	448318	451344	454355	457352	460334	2		
59	45	433018	436119	439204	442274	445329	448369	451394	454405	457401	460383	1		
60	0	9.433070	9.436170	9.439255	9.442325	9.445379	9.448419	9.451445	9.454455	9.457451	9.460433	0		
		49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m			

	20 ^m	21 ^m	22 ^m	23 ^m	24 ^m	25 ^m	26 ^m	27 ^m	28 ^m	29 ^m		
	65 deg.				66 deg.				67 deg.			
SEC	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	SEC	
0	9.460433	9.463400	9.466354	9.469293	9.472218	9.475129	9.478026	9.480909	9.483779	9.486635	60	
1	15 460483	463450	466403	469341	472266	475177	478074	480957	483827	486683	59	
2	30 460532	463499	466452	469390	472315	475225	478122	481005	483874	486730	58	
3	45 460582	463548	466501	469439	472363	475274	478170	481053	483922	486778	57	
	1'	16'	31'	46'	1'	16'	31'	46'	1'	16'		
4	0 9.460631	9.463598	9.466550	9.469488	9.472412	9.475322	9.478218	9.481101	9.483970	9.486825	56	
5	15 460681	463647	466599	469537	472461	475371	478267	481149	484018	486873	55	
6	30 460730	463696	466648	469586	472509	475419	478315	481197	484065	486920	54	
7	45 460780	463746	466697	469634	472558	475467	478363	481245	484113	486968	53	
	2'	17'	32'	47'	2'	17'	32'	47'	2'	17'		
8	0 9.460830	9.463795	9.466746	9.469683	9.472606	9.475516	9.478411	9.481293	9.484161	9.487015	52	
9	15 460879	463844	466795	469732	472655	475564	478459	481341	484208	487062	51	
10	30 460929	463894	466844	469781	472704	475612	478507	481388	484256	487110	50	
11	45 460978	463943	466893	469830	472752	475661	478555	481436	484304	487157	49	
	3'	18'	33'	48'	3'	18'	33'	48'	3'	18'		
12	0 9.461028	9.463992	9.466942	9.469879	9.472801	9.475709	9.478604	9.481484	9.484351	9.487205	48	
13	15 461077	464041	466991	469927	472849	475757	478652	481532	484399	487252	47	
14	30 461127	464091	467041	469976	472898	475806	478700	481580	484447	487300	46	
15	45 461176	464140	467090	470025	472947	475854	478748	481628	484494	487347	45	
	4'	19'	34'	49'	4'	19'	34'	49'	4'	19'		
16	0 9.461226	9.464189	9.467139	9.470074	9.472995	9.475903	9.478796	9.481676	9.484542	9.487395	44	
17	15 461275	464238	467188	470123	473044	475951	478844	481724	484590	487442	43	
18	30 461325	464288	467237	470172	473092	475999	478892	481772	484637	487489	42	
19	45 461374	464337	467286	470220	473141	476047	478940	481819	484685	487537	41	
	5'	20'	35'	50'	5'	20'	35'	50'	5'	20'		
20	0 9.461424	9.464386	9.467335	9.470269	9.473189	9.476096	9.478988	9.481867	9.484733	9.487584	40	
21	15 461473	464436	467384	470318	473238	476144	479037	481915	484780	487632	39	
22	30 461523	464485	467433	470367	473287	476192	479085	481963	484828	487679	38	
23	45 461572	464534	467482	470415	473335	476241	479133	482011	484875	487726	37	
	6'	21'	36'	51'	6'	21'	36'	51'	6'	21'		
24	0 9.461622	9.464583	9.467531	9.470464	9.473384	9.476289	9.479181	9.482059	9.484923	9.487774	36	
25	15 461671	464633	467580	470513	473432	476337	479229	482107	484971	487821	35	
26	30 461721	464682	467629	470562	473481	476386	479277	482154	485018	487869	34	
27	45 461770	464731	467678	470610	473529	476434	479325	482202	485066	487916	33	
	7'	22'	37'	52'	7'	22'	37'	52'	7'	22'		
28	0 9.461820	9.464780	9.467727	9.470659	9.473578	9.476482	9.479373	9.482250	9.485114	9.487963	32	
29	15 461869	464829	467776	470708	473626	476531	479421	482298	485161	488011	31	
30	30 461919	464879	467825	470757	473675	476579	479469	482346	485209	488058	30	
31	45 461968	464928	467874	470805	473723	476627	479517	482394	485256	488106	29	
	8'	23'	38'	53'	8'	23'	38'	53'	8'	23'		
32	0 9.462017	9.464977	9.467923	9.470854	9.473772	9.476675	9.479565	9.482441	9.485304	9.488153	28	
33	15 462067	465026	467972	470903	473820	476724	479613	482489	485352	488200	27	
34	30 462116	465076	468021	470952	473869	476772	479661	482537	485399	488248	26	
35	45 462166	465125	468070	471000	473917	476820	479709	482585	485447	488295	25	
	9'	24'	39'	54'	9'	24'	39'	54'	9'	24'		
36	0 9.462215	9.465174	9.468119	9.471049	9.473966	9.476869	9.479757	9.482633	9.485494	9.488342	24	
37	15 462265	465223	468168	471098	474014	476917	479806	482681	485542	488390	23	
38	30 462314	465272	468217	471147	474063	476965	479854	482728	485589	488437	22	
39	45 462363	465321	468265	471195	474111	477013	479902	482776	485637	488484	21	
	10'	25'	40'	55'	10'	25'	40'	55'	10'	25'		
40	0 9.462413	9.465371	9.468314	9.471244	9.474160	9.477062	9.479950	9.482824	9.485685	9.488532	20	
41	15 462462	465420	468363	471293	474208	477110	479998	482872	485732	488579	19	
42	30 462512	465469	468412	471342	474257	477158	480046	482919	485780	488627	18	
43	45 462561	465518	468462	471390	474305	477206	480094	482967	485827	488674	17	
	11'	26'	41'	56'	11'	26'	41'	56'	11'	26'		
44	0 9.462611	9.465567	9.468510	9.471439	9.474354	9.477253	9.480142	9.483015	9.485875	9.488721	16	
45	15 462660	465617	468559	471488	474402	477303	480190	483063	485922	488768	15	
46	30 462709	465666	468608	471536	474451	477351	480238	483111	485971	488816	14	
47	45 462759	465715	468657	471585	474499	477399	480286	483158	486017	488863	13	
	12'	27'	42'	57'	12'	27'	42'	57'	12'	27'		
48	0 9.462808	9.465764	9.468706	9.471634	9.474547	9.477447	9.480334	9.483206	9.486063	9.488910	12	
49	15 462857	465813	468755	471682	474596	477496	480382	483254	486113	488958	11	
50	30 462907	465862	468804	471731	474644	477544	480430	483302	486160	489005	10	
51	45 462956	465911	468853	471780	474693	477592	480478	483349	486208	489052	9	
	13'	28'	43'	58'	13'	28'	43'	58'	13'	28'		
52	0 9.463006	9.465961	9.468901	9.471828	9.474741	9.477640	9.480526	9.483397	9.486255	9.489100	8	
53	15 463055	466010	468950	471877	474790	477688	480574	483445	486303	489147	7	
54	30 463104	466059	468999	471926	474838	477737	480621	483493	486350	489194	6	
55	45 463154	466108	469048	471974	474886	477785	480669	483540	486398	489242	5	
	14'	29'	44'	59'	14'	29'	44'	59'	14'	29'		
56	0 9.463203	9.466157	9.469097	9.472023	9.474935	9.477833	9.480717	9.483588	9.486445	9.489289	4	
57	15 463252	466206	469146	472072	474983	477881	480765	483636	486493	489336	3	
58	30 463302	466255	469195	472120	475032	477929	480813	483684	486540	489383	2	
59	45 463351	466304	469244	472169	475080	477978	480861	483731	486588	489431	1	
60	0 9.463400	9.466354	9.469293	9.472218	9.475129	9.478026	9.480909	9.483779	9.486635	9.489478	0	
	39 ^m	38 ^m	37 ^m	36 ^m	35 ^m	34 ^m	33 ^m	32 ^m	31 ^m	30 ^m	SEC	

sec	30 ^m					31 ^m					32 ^m					33 ^m					34 ^m					35 ^m					36 ^m					37 ^m					38 ^m					39 ^m					sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	67 deg.					68 deg.					69 deg.					70 deg.					71 deg.					72 deg.					73 deg.					74 deg.					75 deg.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	30'	31'	32'	33'	34'	35'	36'	37'	38'	39'	40'	41'	42'	43'	44'	45'	46'	47'	48'	49'	50'	51'	52'	53'	54'	55'	56'	57'	58'	59'	60'	61'	62'	63'	64'	65'	66'	67'	68'	69'	70'	71'	72'	73'	74'	75'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
0	9.489478	9.492307	9.495123	9.497926	9.500716	9.503492	9.506256	9.509007	9.511745	9.514470	9.517188	9.519897	9.522597	9.525288	9.527969	9.530640	9.533299	9.535947	9.538584	9.541210	9.543825	9.546429	9.549022	9.551603	9.554172	9.556729	9.559274	9.561807	9.564328	9.566837	9.569334	9.571818	9.574289	9.576747	9.579192	9.581624	9.584043	9.586449	9.588842	9.591222	9.593589	9.595943	9.598284	9.600612	9.602927	9.605230	9.607521	9.609800	9.612067	9.614322	9.616565	9.618797	9.621018	9.623228	9.625427	9.627615	9.629792	9.631958	9.634113	9.636257	9.638390	9.640512	9.642624	9.644725	9.646816	9.648896	9.650966	9.653025	9.655074	9.657113	9.659142	9.661161	9.663170	9.665169	9.667158	9.669137	9.671106	9.673065	9.675014	9.676953	9.678882	9.680801	9.682710	9.684609	9.686498	9.688377	9.690246	9.692105	9.693954	9.695793	9.697622	9.699441	9.701250	9.703049	9.704838	9.706617	9.708386	9.710145	9.711894	9.713633	9.715362	9.717081	9.718790	9.720489	9.722178	9.723857	9.725526	9.727185	9.728834	9.730473	9.732102	9.733721	9.735330	9.736929	9.738518	9.740097	9.741666	9.743225	9.744774	9.746313	9.747842	9.749361	9.750870	9.752369	9.753858	9.755337	9.756806	9.758265	9.759714	9.761153	9.762582	9.764001	9.765410	9.766809	9.768198	9.769577	9.770946	9.772305	9.773654	9.775003	9.776342	9.777671	9.779000	9.780319	9.781628	9.782927	9.784216	9.785495	9.786764	9.788023	9.789272	9.790511	9.791740	9.792959	9.794168	9.795367	9.796556	9.797735	9.798904	9.800063	9.801212	9.802351	9.803480	9.804599	9.805708	9.806807	9.807896	9.808975	9.810044	9.811103	9.812152	9.813191	9.814220	9.815239	9.816258	9.817267	9.818266	9.819255	9.820234	9.821203	9.822162	9.823111	9.824050	9.824979	9.825908	9.826827	9.827736	9.828635	9.829524	9.830403	9.831272	9.832131	9.832980	9.833819	9.834648	9.835467	9.836276	9.837075	9.837864	9.838643	9.839412	9.840171	9.840920	9.841659	9.842388	9.843107	9.843816	9.844515	9.845204	9.845883	9.846552	9.847211	9.847860	9.848499	9.849128	9.849747	9.850356	9.850955	9.851544	9.852123	9.852692	9.853251	9.853800	9.854339	9.854868	9.855387	9.855896	9.856395	9.856884	9.857363	9.857832	9.858291	9.858740	9.859179	9.859608	9.860027	9.860436	9.860835	9.861224	9.861603	9.861972	9.862331	9.862680	9.863019	9.863358	9.863687	9.864016	9.864335	9.864644	9.864943	9.865232	9.865511	9.865780	9.866049	9.866308	9.866557	9.866806	9.867045	9.867274	9.867493	9.867702	9.867901	9.868090	9.868269	9.868438	9.868597	9.868746	9.868885	9.869014	9.869133	9.869252	9.869361	9.869460	9.869559	9.869648	9.869727	9.869806	9.869875	9.869934	9.869983	9.870022	9.870051	9.870070	9.870089	9.870108	9.870117	9.870126	9.870125	9.870124	9.870123	9.870122	9.870121	9.870120	9.870119	9.870118	9.870117	9.870116	9.870115	9.870114	9.870113	9.870112	9.870111	9.870110	9.870109	9.870108	9.870107	9.870106	9.870105	9.870104	9.870103	9.870102	9.870101	9.870100	9.870099	9.870098	9.870097	9.870096	9.870095	9.870094	9.870093	9.870092	9.870091	9.870090	9.870089	9.870088	9.870087	9.870086	9.870085	9.870084	9.870083	9.870082	9.870081	9.870080	9.870079	9.870078	9.870077	9.870076	9.870075	9.870074	9.870073	9.870072	9.870071	9.870070	9.870069	9.870068	9.870067	9.870066	9.870065	9.870064	9.870063	9.870062	9.870061	9.870060	9.870059	9.870058	9.870057	9.870056	9.870055	9.870054	9.870053	9.870052	9.870051	9.870050	9.870049	9.870048	9.870047	9.870046	9.870045	9.870044	9.870043	9.870042	9.870041	9.870040	9.870039	9.870038	9.870037	9.870036	9.870035	9.870034	9.870033	9.870032	9.870031	9.870030	9.870029	9.870028	9.870027	9.870026	9.870025	9.870024	9.870023	9.870022	9.870021	9.870020	9.870019	9.870018	9.870017	9.870016	9.870015	9.870014	9.870013	9.870012	9.870011	9.870010	9.870009	9.870008	9.870007	9.870006	9.870005	9.870004	9.870003	9.870002	9.870001	9.869990	9.869989	9.869988	9.869987	9.869986	9.869985	9.869984	9.869983	9.869982	9.869981	9.869980	9.869979	9.869978	9.869977	9.869976	9.869975	9.869974	9.869973	9.869972	9.869971	9.869970	9.869969	9.869968	9.869967	9.869966	9.869965	9.869964	9.869963	9.869962	9.869961	9.869960	9.869959	9.869958	9.869957	9.869956	9.869955	9.869954	9.869953	9.869952	9.869951	9.869950	9.869949	9.869948	9.869947	9.869946	9.869945	9.869944	9.869943	9.869942	9.869941	9.869940	9.869939	9.869938	9.869937	9.869936	9.869935	9.869934	9.869933	9.869932	9.869931	9.869930	9.869929	9.869928	9.869927	9.869926	9.869925	9.869924	9.869923	9.869922	9.869921	9.869920	9.869919	9.869918	9.869917	9.869916	9.869915	9.869914	9.869913	9.869912	9.869911	9.869910	9.869909	9.869908	9.869907	9.869906	9.869905	9.869904	9.869903	9.869902	9.869901	9.869900	9.869899	9.869898	9.869897	9.869896	9.869895	9.869894	9.869893	9.869892	9.869891	9.869890	9.869889	9.869888	9.869887	9.869886	9.869885	9.869884	9.869883	9.869882	9.869881	9.869880	9.869879	9.869878	9.869877	9.869876	9.869875	9.869874	9.869873	9.869872	9.869871	9.869870	9.869869	9.869868	9.869867	9.869866	9.869865	9.869864	9.869863	9.869862	9.869861	9.869860	9.869859	9.869858	9.869857	9.869856	9.869855	9.869854	9.869853	9.869852	9.869851	9.869850	9.869849	9.869848	9.869847	9.869846	9.869845	9.869844	9.869843	9.869842	9.869841	9.869840	9.869839	9.869838	9.869837	9.869836	9.869835	9.869834	9.869833	9.869832	9.869831	9.869830	9.869829	9.869828	9.869827	9.869826	9.869825	9.869824	9.869823	9.869822	9.869821	9.869820	9.869819	9.869818	9.869817	9.869816	9.869815	9.869814	9.869813	9.869812	9.869811	9.869810	9.869809	9.869808	9.869807	9.869806	9.869805	9.869804	9.869803	9.869802	9.869801	9.869800	9.869799	9.869798	9.869797	9.869796	9.869795	9.869794	9.869793	9.869792	9.869791	9.869790	9.869789	9.869788	9.869787	9.869786	9.869785	9.869784	9.869783	9.869782	9.869781	9.869780	9.869779	9.869778	9.869777	9.869776	9.869775	9.869774	9.869773	9.869772	9.869771	9.869770	9.869769	9.869768	9.869767	9.869766	9.869765	9.869764	9.869763	9.869762	9.869761	9.869760	9.869759	9.869758	9.869757	9.869756	9.869755	9.869754	9.869753	9.869752	9.869751	9.869750	9.869749	9.869748	9.869747	9.869746	9.869745	9.869744	9.869743	9.869742	9.869741	9.869740	9.869739	9.869738	9.869737	9.869736	9.869735	9.869734	9.869733	9.869732	9.869731	9.869730	9.869729	9.869728	9.869727	9.869726	9.869725	9.869724	9.869723	9.869722	9.869721	9.869720	9.869719	9.869718	9.869717	9.869716	9.869715	9.869714	9.869713	9.869712	9.869711	9.869710	9.869709	9.869708	9.869707	9.869706	9.869705	9.869704	9.869703	9.869702	9.869701	9.869700	9.869699	9.869698	9.869697	9.869696	9.869695	9.869694	9.869693	9.869692	9.869691	9.869690	9.869689	9.869688	9.869687	9.869686	9.869685	9.869684	9.869683	9.869682	9.869681	9.869680	9.869679	9.869678	9.869677	9.869676	9.869675	9.869674	9.869673	9.869672	9.869671	9.869670	9.869669	9.869668	9.869667	9.869666	9.869665	9.869664	9.869663	9.869662	9.869661	9.869660	9.869659	9.869658	9.869657	9.869656	9.869655	9.869654	9.869653	9.869652	9.869651	9.869650	9.869649	9.869648	9.869647	9.869646	9.869645	9.869644	9.869643	9.869642	9.869641	9.869640	9.869639	9.869638	9.869637	9.869636	9.869635	9.869634	9.869633	9.869632	9.869631	9.869630	9.869629	9.869628	9.869627	9.869626	9.869625	9.869624	9.869623	9.869622	9.869621	9.869620	9.869619	9.869618	9.869617	9.869616	9.869615	9.869614	9.869613	9.869612	9.869611	9.869610	9.869609	9.869608	9.869607	9.869606	9.869605	9.869604	9.869603	9.869602	9.869601	9.869600	9.869599	9.869598	9.869597	9.869596	9.869595	9.869594	9.869593	9.869592	9.869591	9.869590	9.869589	9.869588	9.869587	9.869586	9.869585	9.869584	9.869583	9.869582	9.869581	9.869580	9.869579	9.869578	9.869577	9.869576	9.869575	9.869574	9.869573	9.869572	9.869571	9.869570	9.869569	9.869568	9.8695675

	40 ^m	41 ^m	42 ^m	43 ^m	44 ^m	45 ^m	46 ^m	47 ^m	48 ^m	49 ^m	
70 deg.											
0'	9.517183	9.519883	9.522570	9.525245	9.527908	9.530559	9.533197	9.535823	9.538437	9.541040	60
15	517223	519928	522615	525290	527952	530603	533241	535867	538481	541083	59
30	517273	519972	522660	525334	527997	530647	533285	535911	538524	541126	58
45	517318	520017	522704	525379	528041	530691	533328	535954	538568	541169	57
1'	9.517363	9.520062	9.522749	9.525423	9.528085	9.530735	9.533372	9.535998	9.538611	9.541213	56
15	517408	520107	522794	525468	528129	530779	533416	536041	538655	541256	55
30	517453	520152	522838	525512	528174	530823	533460	536085	538698	541299	54
45	517498	520197	522883	525557	528218	530867	533504	536129	538741	541342	53
2'	9.517543	9.520242	9.522928	9.525601	9.528262	9.530911	9.533548	9.536172	9.538785	9.541386	52
9	517588	520287	522972	525645	528306	530955	533592	536216	538828	541429	51
10	517633	520331	523017	525690	528351	530999	533635	536260	538872	541472	50
11	517679	520376	523062	525734	528395	531043	533679	536303	538915	541515	49
3'	9.517724	9.520421	9.523106	9.525779	9.528439	9.531087	9.533723	9.536347	9.538959	9.541559	48
13	517769	520466	523151	525823	528483	531131	533767	536391	539003	541602	47
14	517814	520511	523195	525868	528528	531175	533811	536434	539046	541645	46
15	517859	520556	523240	525912	528572	531219	533855	536478	539089	541688	45
4'	9.517904	9.520601	9.523285	9.525957	9.528616	9.531263	9.533898	9.536521	9.539132	9.541732	44
16	517949	520645	523329	526001	528660	531307	533942	536565	539176	541775	43
17	517994	520690	523374	526045	528705	531351	533986	536609	539219	541818	42
19	518039	520735	523419	526089	528749	531395	534030	536652	539263	541861	41
5'	9.518084	9.520780	9.523463	9.526134	9.528793	9.531439	9.534074	9.536699	9.539306	9.541904	40
20	518129	520825	523508	526179	528837	531483	534117	536739	539349	541947	39
21	518174	520870	523552	526223	528881	531527	534161	536783	539393	541991	38
23	518219	520914	523597	526267	528926	531571	534205	536827	539436	542034	37
6'	9.518264	9.520959	9.523642	9.526312	9.528970	9.531615	9.534249	9.536870	9.539480	9.542077	36
24	518309	521004	523686	526356	529014	531659	534303	536914	539523	542120	35
25	518354	521049	523731	526401	529058	531703	534336	536957	539566	542164	34
27	518399	521094	523775	526445	529102	531747	534380	537001	539610	542207	33
7'	9.518444	9.521138	9.523820	9.526489	9.529147	9.531791	9.534424	9.537045	9.539653	9.542250	32
28	518489	521183	523865	526534	529191	531835	534468	537089	539697	542293	31
29	518534	521228	523909	526578	529235	531879	534512	537132	539740	542336	30
31	518579	521273	523954	526623	529279	531923	534555	537175	539783	542379	29
8'	9.518624	9.521318	9.523998	9.526667	9.529323	9.531967	9.534599	9.537219	9.539827	9.542423	28
32	518669	521362	524043	526711	529367	532011	534643	537262	539870	542466	27
33	518714	521407	524088	526756	529412	532055	534687	537306	539913	542509	26
35	518759	521452	524132	526800	529456	532099	534730	537349	539957	542552	25
9'	9.518804	9.521497	9.524177	9.526844	9.529500	9.532143	9.534774	9.537393	9.540000	9.542595	24
36	518849	521541	524221	526889	529544	532187	534818	537437	540043	542638	23
37	518894	521586	524266	526933	529588	532231	534862	537480	540087	542682	22
39	518939	521631	524310	526977	529632	532275	534905	537524	540130	542725	21
10'	9.518984	9.521676	9.524355	9.527022	9.529676	9.532319	9.534949	9.537567	9.540174	9.542768	20
40	519029	521720	524399	527066	529721	532363	534993	537611	540217	542811	19
42	519074	521765	524444	527111	529765	532407	535037	537654	540260	542854	18
43	519119	521810	524489	527155	529809	532451	535080	537698	540303	542897	17
11'	9.519164	9.521855	9.524533	9.527199	9.529853	9.532495	9.535124	9.537741	9.540347	9.542940	16
44	519209	521899	524578	527243	529897	532539	535168	537785	540390	542983	15
45	519254	521944	524622	527288	529941	532582	535211	537828	540433	543027	14
47	519299	521989	524667	527332	529985	532626	535255	537872	540477	543070	13
12'	9.519344	9.522034	9.524711	9.527376	9.530029	9.532670	9.535299	9.537915	9.540520	9.543113	12
48	519389	522078	524756	527421	530074	532714	535343	537959	540563	543156	11
49	519433	522123	524800	527465	530118	532758	535386	538003	540607	543199	10
51	519478	522168	524845	527509	530162	532802	535430	538046	540650	543242	9
13'	9.519523	9.522213	9.524889	9.527554	9.530206	9.532846	9.535474	9.538099	9.540693	9.543285	8
52	519568	522257	524934	527598	530250	532890	535517	538133	540737	543328	7
53	519613	522302	524978	527642	530294	532934	535561	538176	540780	543371	6
55	519658	522347	525023	527687	530338	532977	535605	538220	540823	543414	5
14'	9.519703	9.522391	9.525067	9.527731	9.530382	9.533021	9.535648	9.538263	9.540866	9.543458	4
56	519748	522436	525112	527775	530426	533065	535692	538307	540910	543501	3
58	519793	522481	525156	527820	530470	533109	535736	538350	540953	543544	2
59	519838	522525	525201	527864	530514	533153	535779	538394	540997	543587	1
60	9.519883	9.522570	9.525245	9.527908	9.530559	9.533197	9.535823	9.538437	9.541040	9.543630	0
	19 ^m	18 ^m	17 ^m	16 ^m	15 ^m	14 ^m	13 ^m	12 ^m	11 ^m	10 ^m	

		50 ^m	51 ^m	52 ^m	53 ^m	54 ^m	55 ^m	56 ^m	57 ^m	58 ^m	59 ^m		
		72 deg.		73 deg.				74 deg.					
sec.		30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	sec.	
0	0	9.543630	9.546208	9.548775	9.551330	9.553874	9.556406	9.558926	9.561435	9.563932	9.566419	60	0
1	15	543673	546251	548818	551373	553916	556448	558968	561477	563974	566460	59	15
2	30	543716	546294	548861	551415	553958	556490	559010	561518	564016	566502	58	30
3	45	543759	546337	548903	551458	554001	556532	559052	561560	564057	566543	57	45
4	0	9.543802	9.546380	9.548946	9.551500	9.554043	9.556574	9.559094	9.561602	9.564099	9.566584	56	0
5	15	543845	546423	548989	551543	554085	556616	559136	561644	564140	566626	55	15
6	30	543888	546466	549032	551585	554127	556658	559177	561685	564182	566668	54	30
7	45	543931	546508	549074	551628	554170	556700	559219	561727	564223	566708	53	45
8	0	9.543974	9.546551	9.549117	9.551670	9.554212	9.556742	9.559261	9.561769	9.564265	9.566750	52	0
9	15	544017	546594	549159	551712	554254	556784	559303	561810	564306	566791	51	15
10	30	544061	546637	549202	551755	554297	556826	559345	561852	564348	566832	50	30
11	45	544103	546680	549244	551797	554339	556869	559387	561894	564389	566874	49	45
12	0	9.544147	9.546723	9.549287	9.551840	9.554381	9.556911	9.559429	9.561935	9.564431	9.566915	48	0
13	15	544190	546766	549330	551882	554423	556953	559471	561977	564472	566956	47	15
14	30	544233	546808	549372	551925	554466	556995	559513	562019	564514	566998	46	30
15	45	544276	546851	549415	551967	554507	557037	559554	562061	564555	567039	45	45
16	0	9.544319	9.546894	9.549458	9.552010	9.554550	9.557079	9.559596	9.562102	9.564597	9.567080	44	0
17	15	544362	546937	549500	552052	554592	557121	559638	562144	564638	567121	43	15
18	30	544405	546980	549543	552095	554635	557163	559680	562186	564680	567163	42	30
19	45	544448	547022	549586	552137	554677	557205	559722	562227	564721	567204	41	45
20	0	9.544491	9.547065	9.549628	9.552179	9.554719	9.557247	9.559764	9.562269	9.564763	9.567245	40	0
21	15	544534	547108	549671	552222	554761	557289	559805	562311	564804	567287	39	15
22	30	544577	547151	549713	552264	554803	557331	559847	562352	564846	567328	38	30
23	45	544620	547194	549756	552307	554846	557373	559889	562394	564887	567369	37	45
24	0	9.544663	9.547237	9.549799	9.552349	9.554888	9.557415	9.559931	9.562435	9.564929	9.567411	36	0
25	15	544706	547279	549841	552391	554930	557457	559973	562477	564970	567452	35	15
26	30	544749	547322	549884	552434	554972	557499	560015	562519	565012	567493	34	30
27	45	544792	547365	549927	552476	555014	557541	560057	562560	565053	567534	33	45
28	0	9.544835	9.547408	9.549969	9.552519	9.555057	9.557583	9.560098	9.562602	9.565094	9.567576	32	0
29	15	544878	547450	550012	552561	555099	557625	560140	562644	565136	567617	31	15
30	30	544921	547493	550054	552603	555141	557667	560182	562685	565177	567658	30	30
31	45	544964	547536	550097	552646	555183	557709	560224	562727	565219	567699	29	45
32	0	9.545007	9.547579	9.550139	9.552688	9.555226	9.557751	9.560266	9.562769	9.565260	9.567741	28	0
33	15	545050	547622	550182	552731	555268	557793	560307	562810	565302	567782	27	15
34	30	545093	547664	550224	552773	555310	557835	560349	562852	565343	567823	26	30
35	45	545135	547707	550267	552815	555352	557877	560391	562893	565384	567864	25	45
36	0	9.545178	9.547750	9.550310	9.552858	9.555394	9.557919	9.560433	9.562935	9.565426	9.567906	24	0
37	15	545221	547793	550352	552900	555436	557961	560475	562977	565467	567947	23	15
38	30	545264	547835	550395	552942	555479	558003	560516	563018	565509	567988	22	30
39	45	545307	547878	550437	552985	555521	558045	560558	563060	565550	568029	21	45
40	0	9.545350	9.547921	9.550480	9.553027	9.555563	9.558087	9.560600	9.563101	9.565592	9.568070	20	0
41	15	545393	547964	550522	553070	555605	558129	560642	563143	565633	568112	19	15
42	30	545436	548006	550565	553112	555647	558171	560684	563185	565674	568153	18	30
43	45	545479	548049	550607	553154	555689	558213	560725	563226	565716	568194	17	45
44	0	9.545522	9.548092	9.550650	9.553197	9.555732	9.558255	9.560767	9.563268	9.565757	9.568235	16	0
45	15	545565	548135	550693	553239	555774	558297	560809	563309	565798	568276	15	15
46	30	545608	548177	550735	553281	555816	558339	560851	563351	565840	568318	14	30
47	45	545651	548220	550778	553324	555858	558381	560892	563392	565881	568359	13	45
48	0	9.545694	9.548263	9.550820	9.553366	9.555900	9.558423	9.560934	9.563434	9.565923	9.568400	12	0
49	15	545737	548305	550860	553408	555942	558465	560976	563476	565964	568441	11	15
50	30	545780	548348	550905	553451	555984	558507	561018	563517	566005	568483	10	30
51	45	545822	548391	550948	553493	556027	558549	561059	563559	566047	568524	9	45
52	0	9.545865	9.548434	9.550990	9.553535	9.556069	9.558591	9.561101	9.563600	9.566088	9.568565	8	0
53	15	545908	548476	551033	553578	556111	558633	561143	563642	566130	568606	7	15
54	30	545951	548519	551075	553620	556153	558675	561185	563683	566171	568647	6	30
55	45	545994	548562	551118	553662	556195	558716	561226	563725	566212	568688	5	45
56	0	9.546037	9.548604	9.551160	9.553705	9.556237	9.558758	9.561268	9.563767	9.566254	9.568730	4	0
57	15	546080	548647	551203	553747	556279	558800	561310	563808	566295	568771	3	15
58	30	546123	548690	551245	553789	556321	558842	561352	563850	566336	568812	2	30
59	45	546166	548732	551288	553831	556364	558884	561393	563891	566378	568853	1	45
60	0	9.546208	9.548775	9.551330	9.553874	9.556406	9.558926	9.561435	9.563932	9.566419	9.568894	0	0
		9 ^m	8 ^m	7 ^m	6 ^m	5 ^m	4 ^m	3 ^m	2 ^m	1 ^m	0 ^m		

		0 ^m				1 ^m				2 ^m				3 ^m				4 ^m				5 ^m				6 ^m				7 ^m				8 ^m				9 ^m											
		75 deg.																76 deg.																77 deg.															
sec.		0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'																
0	0	9.568894	9.571358	9.573811	9.576253	9.578684	9.581104	9.583513	9.585911	9.588299	9.590676	9.593042	9.595397	9.597741	9.599974	9.602295	9.604604	9.606901	9.609186	9.611458	9.613718	9.615966	9.618201	9.620423	9.622632	9.624828	9.627011	9.629181	9.631338	9.633481	9.635610	9.637725	9.639826																
1	15	568933	571399	573852	576294	578724	581144	583553	585951	588339	590716	593082	595437	597781	600114	602435	604744	607041	609326	611600	613861	616109	618344	620566	622775	624971	627154	629324	631481	633624	635753	637868	639969																
2	30	568977	571440	573893	576334	578765	581184	583593	585991	588379	590755	593120	595475	597819	600152	602473	604782	607079	609364	611637	613897	616144	618378	620600	622809	624995	627159	629311	631450	633576	635689	637789	639876																
3	45	569018	571481	573933	576375	578805	581225	583633	586031	588418	590795	593160	595515	597869	600212	602543	604862	607169	609464	611747	614017	616274	618518	620749	622967	625172	627364	629543	631709	633862	635992	638109	640213																
4	0	9.569059	9.571522	9.573974	9.576415	9.578846	9.581265	9.583673	9.586071	9.588458	9.590834	9.593200	9.595555	9.597900	9.600233	9.602554	9.604862	9.607158	9.609441	9.611711	9.613968	9.616212	9.618443	9.620661	9.622866	9.625058	9.627237	9.629403	9.631556	9.633696	9.635823	9.637937	9.640038																
5	15	569100	571563	574015	576456	578886	581305	583713	586111	588498	590874	593239	595594	597939	600272	602593	604902	607198	609481	611751	614008	616252	618483	620691	622886	625068	627237	629393	631536	633666	635782	637885	639975																
6	30	569141	571604	574056	576497	578926	581345	583753	586151	588537	590912	593277	595632	597977	600310	602631	604940	607236	609519	611789	614046	616290	618521	620739	622944	625136	627315	629481	631634	633774	635899	638011	640110																
7	45	569182	571645	574097	576537	578967	581386	583793	586191	588577	590952	593317	595672	598017	600350	602671	604980	607276	609559	611829	614086	616330	618561	620779	622984	625176	627355	629521	631674	633814	635940	638053	640153																
8	0	9.569223	9.571686	9.574137	9.576578	9.579007	9.581426	9.583834	9.586230	9.588617	9.590992	9.593357	9.595712	9.598057	9.600390	9.602711	9.605020	9.607317	9.609601	9.611872	9.614130	9.616374	9.618605	9.620823	9.623028	9.625219	9.627406	9.629579	9.631739	9.633886	9.636019	9.638138	9.640243																
9	15	569265	571727	574178	576618	579048	581																																										

	10 ^m	11 ^m	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m						
SEC.	77 deg.					78 deg.					79 deg.					SEC.
0	0	9.593042	9.595398	9.597744	9.600078	9.602403	9.604717	9.607021	9.609315	9.611598	9.613872	60				
1	15	593082	595437	597783	600117	602442	604756	607059	609353	611636	613909	59				
2	30	593121	595477	597822	600156	602480	604794	607098	609391	611674	613947	58				
3	45	593160	595516	597861	600195	602519	604833	607136	609429	611712	613985	57				
4	0	9.593200	9.595555	9.597900	9.600234	9.602558	9.604871	9.607174	9.609467	9.611750	9.614023	56				
5	15	593239	595594	597939	600273	602596	604910	607213	609505	611788	614061	55				
6	30	593279	595633	597978	600311	602635	604948	607251	609544	611826	614098	54				
7	45	593318	595672	598017	600350	602673	604987	607289	609582	611864	614136	53				
8	0	9.593357	9.595712	9.598056	9.600389	9.602712	9.605025	9.607327	9.609620	9.611902	9.614174	52				
9	15	593396	595751	598095	600428	602751	605063	607366	609658	611940	614212	51				
10	30	593436	595790	598133	600467	602789	605102	607404	609696	611978	614250	50				
11	45	593475	595829	598172	600506	602828	605140	607442	609734	612016	614287	49				
12	0	9.593514	9.595868	9.598211	9.600544	9.602867	9.605179	9.607481	9.609772	9.612054	9.614325	48				
13	15	593554	595907	598250	600583	602905	605217	607519	609810	612092	614363	47				
14	30	593593	595946	598289	600622	602944	605256	607557	609848	612130	614401	46				
15	45	593632	595985	598328	600661	602983	605294	607595	609886	612167	614438	45				
16	0	9.593672	9.596025	9.598367	9.600699	9.603021	9.605333	9.607634	9.609925	9.612205	9.614476	44				
17	15	593711	596064	598406	600738	603059	605371	607672	609963	612243	614514	43				
18	30	593750	596103	598445	600777	603098	605409	607710	610001	612281	614552	42				
19	45	593789	596142	598484	600816	603137	605448	607748	610039	612319	614590	41				
20	0	9.593829	9.596181	9.598523	9.600854	9.603176	9.605486	9.607787	9.610077	9.612357	9.614627	40				
21	15	593868	596220	598562	600893	603215	605525	607825	610115	612395	614665	39				
22	30	593907	596259	598601	600932	603253	605563	607863	610153	612433	614703	38				
23	45	593947	596299	598640	600971	603291	605601	607901	610191	612471	614740	37				
24	0	9.593986	9.596338	9.598679	9.601010	9.603330	9.605640	9.607940	9.610229	9.612509	9.614779	36				
25	15	594025	596377	598718	601048	603368	605678	607978	610267	612547	614816	35				
26	30	594065	596416	598757	601087	603407	605717	608016	610305	612585	614854	34				
27	45	594104	596455	598796	601126	603446	605755	608054	610344	612622	614892	33				
28	0	9.594143	9.596494	9.598835	9.601165	9.603484	9.605794	9.608093	9.610382	9.612660	9.614929	32				
29	15	594182	596533	598873	601203	603523	605832	608131	610420	612698	614967	31				
30	30	594222	596572	598912	601242	603561	605870	608169	610458	612736	615005	30				
31	45	594261	596611	598951	601281	603600	605909	608207	610496	612774	615042	29				
32	0	9.594300	9.596650	9.598990	9.601320	9.603638	9.605947	9.608246	9.610534	9.612812	9.615080	28				
33	15	594339	596689	599029	601358	603677	605986	608284	610572	612850	615118	27				
34	30	594379	596729	599068	601397	603716	606024	608322	610610	612888	615155	26				
35	45	594418	596768	599107	601436	603754	606062	608360	610648	612926	615193	25				
36	0	9.594457	9.596807	9.599146	9.601474	9.603793	9.606101	9.608398	9.610686	9.612963	9.615231	24				
37	15	594496	596846	599185	601513	603831	606139	608436	610724	613001	615268	23				
38	30	594536	596885	599224	601552	603870	606177	608475	610762	613039	615306	22				
39	45	594575	596924	599262	601591	603908	606216	608513	610800	613077	615344	21				
40	0	9.594614	9.596963	9.599301	9.601629	9.603947	9.606254	9.608551	9.610838	9.613115	9.615382	20				
41	15	594653	597002	599340	601668	603985	606293	608589	610876	613153	615419	19				
42	30	594693	597041	599379	601707	604024	606331	608628	610914	613191	615457	18				
43	45	594732	597080	599418	601745	604063	606369	608666	610952	613228	615495	17				
44	0	9.594771	9.597119	9.599457	9.601784	9.604101	9.606408	9.608704	9.610990	9.613266	9.615532	16				
45	15	594810	597158	599496	601823	604140	606446	608742	611028	613304	615570	15				
46	30	594850	597197	599535	601862	604178	606484	608780	611066	613342	615608	14				
47	45	594889	597236	599573	601900	604217	606523	608818	611104	613380	615645	13				
48	0	9.594928	9.597275	9.599612	9.601939	9.604255	9.606561	9.608857	9.611142	9.613418	9.615683	12				
49	15	594967	597314	599651	601978	604294	606599	608895	611180	613456	615721	11				
50	30	595006	597353	599690	602016	604332	606638	608933	611218	613493	615758	10				
51	45	595046	597392	599729	602055	604371	606676	608971	611256	613531	615796	9				
52	0	9.595085	9.597432	9.599778	9.602094	9.604409	9.606714	9.609009	9.611294	9.613569	9.615834	8				
53	15	595124	597471	599807	602132	604448	606753	609048	611332	613607	615872	7				
54	30	595163	597510	599845	602171	604486	606791	609086	611370	613645	615909	6				
55	45	595202	597549	599884	602210	604525	606829	609124	611408	613683	615947	5				
56	0	9.595242	9.597588	9.599923	9.602248	9.604563	9.606868	9.609162	9.611446	9.613720	9.615984	4				
57	15	595281	597627	599962	602287	604602	606906	609200	611484	613758	616022	3				
58	30	595320	597666	600001	602326	604640	606944	609238	611522	613796	616060	2				
59	45	595359	597705	600040	602364	604679	606983	609277	611560	613834	616097	1				
60	0	9.595398	9.597744	9.600078	9.602403	9.604717	9.607021	9.609315	9.611598	9.613872	9.616135	0				
SEC.	49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m	SEC.					

18 HOURS.

SEC.	30 ^m		31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m	SEC.
	82 deg.		83 deg.					84 deg.				
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	45'
0	9.638227	9.640383	9.642529	9.644666	9.646794	9.648913	9.651022	9.653122	9.655213	9.657294	9.659367	60
15	638263	640418	642565	644702	646829	648948	651057	653157	655247	657329	659399	59
30	638299	640454	642601	644737	646865	648983	651092	653192	655282	657363	659433	58
45	638335	640490	642636	644773	646900	649018	651127	653227	655317	657395	659465	57
60	31'	46'	1'	16'	31'	46'	1'	16'	31'	46'	1'	46'
4	09.638371	9.640526	9.642672	9.644808	9.646936	9.649053	9.651162	9.653261	9.655352	9.657433	9.659506	56
5	15	638407	640562	642708	644844	646971	649088	651197	653296	655387	657467	55
6	30	638443	640598	642743	644880	647006	649124	651232	653331	655421	657502	54
7	45	638479	640633	642779	644915	647042	649159	651267	653366	655456	657536	53
9	0	32'	47'	2'	17'	32'	47'	2'	17'	32'	47'	52
8	09.638515	9.640669	9.642815	9.644951	9.647077	9.649194	9.651302	9.653401	9.655491	9.657571	9.659640	51
9	15	638551	640705	642850	644986	647112	649230	651337	653436	655525	657606	50
10	30	638587	640741	642886	645022	647148	649265	651372	653471	655560	657640	50
11	45	638622	640777	642922	645057	647183	649300	651407	653506	655595	657675	49
12	0	33'	48'	3'	18'	33'	48'	3'	18'	33'	48'	48
10	9.638658	9.640813	9.642957	9.645093	9.647219	9.649335	9.651443	9.653541	9.655630	9.657709	9.659789	48
13	15	638694	640848	642993	645128	647254	649370	651478	653575	655664	657744	47
14	30	638730	640884	643029	645164	647289	649406	651513	653610	655699	657779	46
15	45	638766	640920	643064	645199	647325	649441	651548	653645	655734	657813	45
16	0	34'	49'	4'	19'	34'	49'	4'	19'	34'	49'	45
16	09.638802	9.640956	9.643100	9.645235	9.647360	9.649476	9.651583	9.653680	9.655769	9.657848	9.659923	44
17	15	638838	640992	643136	645270	647395	649511	651618	653715	655803	657883	43
18	30	638874	641028	643171	645306	647431	649546	651653	653750	655838	657917	42
19	45	638910	641063	643207	645341	647466	649581	651688	653785	655873	657951	41
20	0	35'	50'	5'	20'	35'	50'	5'	20'	35'	50'	40
20	09.638946	9.641099	9.643243	9.645377	9.647501	9.649617	9.651723	9.653820	9.655907	9.657986	9.659960	40
21	15	638982	641135	643278	645412	647537	649652	651758	653854	655942	658020	39
22	30	639018	641171	643314	645448	647572	649687	651793	653889	655977	658055	38
23	45	639054	641207	643349	645483	647607	649722	651828	653924	656011	658090	37
24	0	36'	51'	6'	21'	36'	51'	6'	21'	36'	51'	36
24	09.639090	9.641242	9.643385	9.645519	9.647643	9.649757	9.651863	9.653959	9.656046	9.658124	9.659937	36
25	15	639126	641278	643421	645554	647678	649792	651898	653994	656081	658159	35
26	30	639162	641314	643456	645590	647713	649828	651933	654029	656116	658193	34
27	45	639198	641350	643492	645625	647749	649863	651968	654064	656150	658228	33
28	0	37'	52'	7'	22'	37'	52'	7'	22'	37'	52'	32
28	09.639234	9.641385	9.643528	9.645660	9.647784	9.649898	9.652003	9.654099	9.656185	9.658262	9.659937	32
29	15	639270	641421	643563	645696	647819	649933	652038	654133	656220	658297	31
30	30	639306	641457	643599	645731	647855	649968	652073	654168	656254	658332	30
31	45	639342	641493	643635	645766	647890	650003	652108	654203	656288	658366	29
32	0	38'	53'	8'	23'	38'	53'	8'	23'	38'	53'	28
32	09.639378	9.641529	9.643670	9.645802	9.647925	9.650039	9.652143	9.654238	9.656324	9.658401	9.659937	28
33	15	639414	641564	643706	645838	647960	650074	652178	654273	656358	658435	27
34	30	639449	641600	643741	645873	647996	650109	652213	654308	656393	658470	26
35	45	639485	641636	643777	645909	648031	650144	652248	654342	656428	658504	25
36	0	39'	54'	9'	24'	39'	54'	9'	24'	39'	54'	24
36	09.639521	9.641672	9.643813	9.645944	9.648066	9.650179	9.652283	9.654377	9.656463	9.658539	9.659937	24
37	15	639557	641707	643848	645980	648101	650214	652318	654412	656497	658573	23
38	30	639593	641743	643884	646015	648137	650249	652353	654447	656532	658608	22
39	45	639629	641779	643919	646050	648172	650285	652388	654482	656567	658642	21
40	0	40'	55'	10'	25'	40'	55'	10'	25'	40'	55'	20
40	09.639665	9.641815	9.643955	9.646086	9.648207	9.650320	9.652423	9.654517	9.656601	9.658677	9.659937	20
41	15	639701	641851	643991	646121	648243	650355	652458	654551	656636	658711	19
42	30	639737	641886	644026	646157	648278	650390	652493	654586	656671	658746	18
43	45	639773	641922	644062	646192	648313	650425	652528	654621	656705	658780	17
44	0	41'	56'	11'	26'	41'	56'	11'	26'	41'	56'	16
44	09.639809	9.641958	9.644097	9.646228	9.648349	9.650460	9.652563	9.654656	9.656740	9.658815	9.659937	16
45	15	639844	641993	644133	646263	648384	650495	652598	654691	656775	658849	15
46	30	639880	642029	644168	646298	648419	650530	652633	654726	656809	658884	14
47	45	639916	642065	644204	646334	648454	650566	652667	654760	656844	658918	13
48	0	42'	57'	12'	27'	42'	57'	12'	27'	42'	57'	12
48	09.639952	9.642101	9.644240	9.646369	9.648490	9.650601	9.652702	9.654795	9.656879	9.658953	9.659937	12
49	15	639988	642136	644275	646405	648525	650636	652737	654830	656913	658987	11
50	30	640024	642172	644311	646440	648560	650671	652772	654865	656948	659022	10
51	45	640060	642208	644346	646476	648595	650706	652807	654899	656982	659056	9
52	0	43'	58'	13'	28'	43'	58'	13'	28'	43'	58'	8
52	09.640096	9.642243	9.644382	9.646511	9.648631	9.650741	9.652842	9.654934	9.657017	9.659091	9.659937	8
53	15	640131	642279	644417	646546	648666	650776	652877	654969	657052	659125	7
54	30	640167	642315	644453	646582	648701	650811	652912	655004	657086	659160	6
55	45	640203	642351	644489	646617	648736	650846	652947	655039	657121	659194	5
56	0	44'	59'	14'	29'	44'	59'	14'	29'	44'	59'	4
56	09.640239	9.642386	9.644524	9.646653	9.648772	9.650881	9.652982	9.655073	9.657156	9.659229	9.659937	4
57	15	640275	642422	644560	646688	648807	650916	653017	655108	657190	659263	3
58	30	640311	642458	644595	646723	648842	650952	653052	655143	657225	659298	2
59	45	640347	642493	644631	646759	648877	650987	653087	655178	657259	659332	1
60	0	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	0
60	09.640383	9.642529	9.644666	9.646794	9.648913	9.651022	9.653122	9.655213	9.657294	9.659367	9.659937	0
61	15	640419	642565	644702	646829	648948	651057	653157	655247	657329	659399	59
62	30	640454	642601	644737	646865	648983	651092	653192	655282	657363	659433	58
63	45	640490	642636	644773	646900	649018	651127	653227	655317	657395	659465	57
64	0	46'	01'	16'	31'	46'	01'	16'	31'	46'	01'	56
65	09.640526	9.642672	9.644808	9.646936	9.649053	9.651162	9.653261	9.655352	9.657433	9.659506	9.659937	56
66	15	640562	642708	644844	646971	649088	651197	653296	655387	657467	659537	55
67	30	640598	642743	644880	647006	649124	651232	653331	655421	657502	659572	54
68	45	640633	642779	644915	647042	649159	651267	653366	655456	657536	659606	53
69	0	47'	02'	17'	32'	47'	02'	17'	32'	47'	02'	52
70	09.640669	9.642815	9.644951	9.647077	9.649194	9.651302	9.653401	9.655491	9.657571	9.659640	9.659937	51
71	15	640705	642850	644986	647112	649230	651337	653436	655525	657606	659676	50
72	30	640741	642886	645022	647148	649265	651372	653471	655560	657640	659710	49
73	45	640777	642922	645057	647183	649300	651407	653506	655595	657675		

		40 ^m	41 ^m	42 ^m	43 ^m	44 ^m	45 ^m	46 ^m	47 ^m	48 ^m	49 ^m		
		85 deg.				86 deg.				87 deg.			
sec.		0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	sec.	
0	0	9.659367	9.661430	9.663485	9.665530	9.667567	9.669594	9.671613	9.673623	9.675624	9.677617	60	0
1	15	659401	661464	663519	665564	667601	669628	671647	673657	675658	677650	59	1
2	30	659436	661499	663553	665598	667634	669662	671680	673690	675691	677683	58	2
3	45	659470	661533	663587	665632	667668	669695	671714	673723	675724	677716	57	3
4	0	1'	16'	31'	46'	1'	16'	31'	46'	1'	16'	56	4
5	15	659505	9.661567	9.663621	9.665666	9.667702	9.669729	9.671747	9.673757	9.675758	9.677749	55	5
6	30	659539	661602	663655	665700	667736	669763	671781	673790	675792	677783	54	6
7	45	659573	661636	663690	665734	667770	669797	671815	673824	675824	677816	53	7
8	0	2'	17'	32'	47'	2'	17'	32'	47'	2'	17'	52	8
9	15	659642	9.661705	9.663758	9.665802	9.667838	9.669864	9.671882	9.673890	9.675891	9.677882	51	9
10	30	659677	661739	663792	665836	667871	669898	671915	673924	675924	677915	50	10
11	45	659711	661773	663826	665870	667905	669931	671949	673957	675957	677948	49	11
12	0	3'	18'	33'	48'	3'	18'	33'	48'	3'	18'	48	12
13	15	9.659780	9.661842	9.663894	9.665938	9.667973	9.669999	9.672016	9.674024	9.676024	9.678014	47	13
14	30	659814	661876	663928	665972	668007	670033	672049	674057	676057	678047	46	14
15	45	659849	661910	663963	666006	668041	670066	672083	674091	676090	678081	45	15
16	0	4'	19'	34'	49'	4'	19'	34'	49'	4'	19'	44	16
17	15	9.659918	9.661979	9.664031	9.666074	9.668108	9.670134	9.672150	9.674158	9.676157	9.678147	43	17
18	30	659952	662013	664065	666108	668142	670167	672183	674191	676190	678180	42	18
19	45	659987	662047	664099	666142	668176	670201	672217	674224	676223	678213	41	19
20	0	5'	20'	35'	50'	5'	20'	35'	50'	5'	20'	40	20
21	15	9.660021	9.662082	9.664133	9.666176	9.668210	9.670235	9.672251	9.674258	9.676256	9.678246	39	21
22	30	660056	662116	664167	666210	668244	670268	672284	674291	676290	678279	38	22
23	45	660090	662150	664201	666244	668277	670302	672318	674325	676323	678312	37	23
24	0	6'	21'	36'	51'	6'	21'	36'	51'	6'	21'	36	24
25	15	660124	662185	664236	666278	668311	670336	672351	674358	676356	678345	35	25
26	30	660159	662219	664270	666312	668345	670369	672385	674391	676389	678378	34	26
27	45	660193	662253	664304	666346	668379	670403	672419	674425	676422	678412	33	27
28	0	7'	22'	37'	52'	7'	22'	37'	52'	7'	22'	32	28
29	15	660227	662287	664338	666380	668413	670437	672452	674458	676456	678445	31	29
30	30	660262	662322	664372	666414	668446	670470	672485	674491	676489	678478	30	30
31	45	660296	662356	664406	666448	668480	670504	672519	674525	676522	678511	29	31
32	0	8'	23'	38'	53'	8'	23'	38'	53'	8'	23'	28	32
33	15	9.660331	9.662390	9.664440	9.666482	9.668514	9.670538	9.672552	9.674558	9.676555	9.678544	27	33
34	30	660365	662424	664474	666515	668548	670571	672586	674591	676589	678577	31	34
35	45	660400	662459	664508	666549	668582	670605	672619	674625	676621	678610	30	35
36	0	9'	24'	39'	54'	9'	24'	39'	54'	9'	24'	29	36
37	15	660434	662493	664542	666583	668615	670638	672653	674658	676655	678643	28	37
38	30	9.660468	9.662527	9.664577	9.666617	9.668649	9.670672	9.672686	9.674692	9.676688	9.678676	27	38
39	45	660503	662561	664611	666651	668683	670706	672720	674725	676721	678709	26	39
40	0	10'	25'	40'	55'	10'	25'	40'	55'	10'	25'	25	40
41	15	660537	662595	664645	666685	668717	670739	672753	674758	676755	678742	24	41
42	30	660571	662630	664679	666719	668751	670773	672787	674792	676788	678775	23	42
43	45	9.660606	9.662661	9.664713	9.666753	9.668784	9.670807	9.672820	9.674825	9.676821	9.678808	22	43
44	0	11'	26'	41'	56'	11'	26'	41'	56'	11'	26'	21	44
45	15	660640	662698	664747	666787	668818	670840	672854	674858	676854	678841	20	45
46	30	660675	662732	664781	666821	668852	670874	672887	674892	676887	678874	19	46
47	45	660709	662767	664815	666855	668886	670908	672921	674925	676921	678907	18	47
48	0	12'	27'	42'	57'	12'	27'	42'	57'	12'	27'	17	48
49	15	9.660743	9.662801	9.664849	9.666889	9.668919	9.670941	9.672951	9.674958	9.676954	9.678940	16	49
50	30	660778	662835	664883	666923	668953	670975	672988	674992	676987	678973	15	50
51	45	660812	662869	664917	666957	668987	671008	673021	675025	677020	679007	14	51
52	0	13'	28'	43'	58'	13'	28'	43'	58'	13'	28'	13	52
53	15	9.660846	9.662903	9.664951	9.666991	9.669021	9.671042	9.673055	9.675058	9.677053	9.679040	12	53
54	30	660881	662938	664986	667024	669054	9.671076	9.673088	9.675092	9.677086	9.679073	11	54
55	45	660915	662972	665020	667058	669088	671109	673121	675125	677120	679106	10	55
56	0	14'	29'	44'	59'	14'	29'	44'	59'	14'	29'	9	56
57	15	660949	663006	665054	667092	669122	671143	673155	675158	677153	679139	8	57
58	30	660984	663040	665088	667126	669156	671176	673188	675192	677186	679172	7	58
59	45	9.661018	9.663074	9.665122	9.667160	9.669190	9.671210	9.673222	9.675225	9.677219	9.679205	6	59
60	0	15'	30'	45'	60'	15'	30'	45'	60'	15'	30'	5	60
1	15	661052	663109	665156	667194	669223	671244	673255	675258	677252	679238	4	1
2	30	661087	663143	665190	667228	669257	671277	673289	675291	677285	679271	3	2
3	45	661121	663177	665224	667262	669291	671311	673322	675325	677319	679304	2	3
4	0	16'	31'	46'	61'	16'	31'	46'	61'	16'	31'	1	4
5	15	9.661156	9.663211	9.665258	9.667296	9.669324	9.671344	9.673356	9.675358	9.677352	9.679337	0	5
6	30	661190	663245	665292	667329	669358	671378	673389	675391	677385	679370	0	6
7	45	661224	663280	665326	667363	669392	671412	673423	675425	677418	679403	0	7
8	0	17'	32'	47'	62'	17'	32'	47'	62'	17'	32'	0	8
9	15	9.661258	9.663314	9.665360	9.667397	9.669426	9.671445	9.673456	9.675458	9.677451	9.679436	0	9
10	30	661293	663348	665394	667431	9.669459	9.671479	9.673489	9.675491	9.677484	9.679469	0	10
11	45	661327	663382	665428	667465	669493	671513	673523	675525	677518	679502	0	11
12	0	18'	33'	48'	63'	18'	33'	48'	63'	18'	33'	0	12
13	15	661362	663416	665462	667499	669527	671546	673556	675558	677551	679535	0	13
14	30	661396	663450	665496	667533	669561	671580	673590	675591	677584	679568	0	14
15	45	9.661430	9.663485	9.665530	9.667567	9.669594	9.671613	9.673623	9.675624	9.677617	9.679601	0	15
16	0	19 ^m	18 ^m	17 ^m	16 ^m	15 ^m	14 ^m	13 ^m	12 ^m	11 ^m	10 ^m	0	16

		50 ^m	51 ^m	52 ^m	53 ^m	54 ^m	55 ^m	56 ^m	57 ^m	58 ^m	59 ^m				
		87 deg.				88 deg.				89 deg.					
sec.		30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	sec.			
0	0	9.679601	9.681576	9.683543	9.685501	9.687450	9.689391	9.691324	9.693248	9.695163	9.697071	60	0		
1	15	679634	681609	683575	685533	687482	689423	691356	693280	695195	697103	59	15		
2	30	679667	681642	683608	685566	687515	689456	691388	693312	695227	697134	58	30		
3	45	679700	681674	683641	685598	687547	689488	691420	693344	695259	697166	57	45		
4	0	9.679733	9.681707	9.683673	9.685631	9.687580	9.689520	9.691452	9.693376	9.695291	9.697198	56	0		
5	15	679766	681740	683706	685663	687612	689552	691484	693408	695323	697229	55	15		
6	30	679799	681773	683739	685696	687645	689585	691516	693440	695355	697261	54	30		
7	45	679832	681806	683771	685728	687677	689617	691548	693472	695387	697293	53	45		
8	0	9.679865	9.681839	9.683804	9.685761	9.687709	9.689649	9.691581	9.693504	9.695418	9.697325	52	0		
9	15	679898	681871	683837	685794	687742	689681	691613	693536	695450	697356	51	15		
10	30	679931	681904	683869	685826	687774	689714	691645	693568	695482	697388	50	30		
11	45	679964	681937	683902	685859	687806	689746	691677	693600	695514	697420	49	45		
12	0	9.679997	9.681970	9.683935	9.685891	9.687839	9.689778	9.691709	9.693632	9.695546	9.697451	48	0		
13	15	680029	682003	683967	685924	687871	689810	691741	693663	695577	697483	47	15		
14	30	680062	682036	684000	685956	687904	689843	691773	693695	695609	697515	46	30		
15	45	680095	682068	684033	685989	687936	689875	691805	693727	695641	697546	45	45		
16	0	9.680128	9.682101	9.684066	9.686021	9.687968	9.689907	9.691838	9.693759	9.695673	9.697578	44	0		
17	15	680161	682134	684098	686054	688001	689939	691870	693791	695705	697610	43	15		
18	30	680194	682167	684131	686086	688033	689972	691902	693823	695737	697641	42	30		
19	45	680227	682200	684163	686119	688066	690004	691934	693855	695768	697673	41	45		
20	0	9.680260	9.682232	9.684196	9.686151	9.688098	9.690036	9.691966	9.693887	9.695800	9.697705	40	0		
21	15	680293	682265	684229	686184	688130	690068	691998	693919	695832	697736	39	15		
22	30	680326	682298	684261	686216	688163	690101	692030	693951	695864	697768	38	30		
23	45	680359	682331	684294	686249	688195	690133	692062	693983	695896	697800	37	45		
24	0	9.680392	9.682364	9.684327	9.686281	9.688227	9.690165	9.692094	9.694015	9.695927	9.697832	36	0		
25	15	680425	682396	684359	686314	688260	690197	692126	694047	695959	697863	35	15		
26	30	680458	682429	684392	686346	688292	690230	692158	694079	695991	697895	34	30		
27	45	680491	682462	684425	686379	688325	690262	692190	694111	696023	697926	33	45		
28	0	9.680524	9.682495	9.684457	9.686411	9.688357	9.690294	9.692223	9.694143	9.696055	9.697958	32	0		
29	15	680557	682528	684490	686444	688389	690326	692255	694175	696086	697990	31	15		
30	30	680589	682560	684523	686476	688422	690358	692287	694207	696118	698021	30	30		
31	45	680622	682593	684555	686509	688454	690391	692319	694239	696150	698053	29	45		
32	0	9.680655	9.682626	9.684588	9.686541	9.688486	9.690423	9.692351	9.694271	9.696182	9.698085	28	0		
33	15	680688	682659	684620	686574	688519	690455	692383	694302	696214	698116	27	15		
34	30	680721	682691	684653	686606	688551	690487	692415	694334	696245	698148	26	30		
35	45	680754	682724	684686	686639	688583	690519	692447	694366	696277	698180	25	45		
36	0	9.680787	9.682757	9.684718	9.686671	9.688616	9.690552	9.692479	9.694398	9.696309	9.698211	24	0		
37	15	680820	682790	684751	686704	688648	690584	692511	694430	696341	698243	23	15		
38	30	680853	682822	684784	686736	688680	690616	692543	694462	696372	698275	22	30		
39	45	680886	682855	684816	686769	688713	690648	692575	694494	696404	698306	21	45		
40	0	9.680919	9.682888	9.684849	9.686801	9.688745	9.690680	9.692607	9.694526	9.696436	9.698338	20	0		
41	15	680951	682921	684882	686834	688777	690712	692639	694558	696468	698369	19	15		
42	30	680984	682953	684914	686866	688810	690745	692671	694590	696500	698401	18	30		
43	45	681017	682986	684947	686899	688843	690777	692703	694622	696531	698433	17	45		
44	0	9.681050	9.683019	9.684979	9.686931	9.688874	9.690809	9.692735	9.694653	9.696563	9.698464	16	0		
45	15	681083	683052	685012	686963	688907	690841	692767	694685	696595	698496	15	15		
46	30	681116	683084	685044	686996	688939	690873	692800	694717	696627	698528	14	30		
47	45	681149	683117	685077	687028	688971	690906	692831	694749	696658	698559	13	45		
48	0	9.681182	9.683150	9.685110	9.687061	9.689004	9.690938	9.692864	9.694781	9.696690	9.698591	12	0		
49	15	681214	683183	685142	687093	689036	690970	692896	694813	696722	698622	11	15		
50	30	681247	683215	685175	687126	689068	691002	692928	694845	696754	698654	10	30		
51	45	681280	683248	685207	687158	689100	691034	692960	694877	696785	698686	9	45		
52	0	9.681313	9.683281	9.685240	9.687191	9.689133	9.691066	9.692992	9.694909	9.696817	9.698717	8	0		
53	15	681346	683314	685273	687223	689165	691099	693024	694940	696849	698749	7	15		
54	30	681379	683346	685305	687255	689197	691131	693056	694972	696881	698780	6	30		
55	45	681412	683379	685338	687289	689230	691163	693088	695004	696912	698812	5	45		
56	0	9.681445	9.683412	9.685370	9.687320	9.689262	9.691195	9.693120	9.695036	9.696944	9.698844	4	0		
57	15	681477	683444	685403	687353	689294	691227	693152	695068	696976	698875	3	15		
58	30	681510	683477	685435	687385	689326	691259	693184	695098	697007	698907	2	30		
59	45	681543	683510	685468	687418	689359	691291	693216	695132	697039	698938	1	45		
60	0	9.681576	9.683543	9.685501	9.687450	9.689391	9.691324	9.693248	9.695163	9.697071	9.698970	0	0		
sec.		9 ^m	8 ^m	7 ^m	6 ^m	5 ^m	4 ^m	3 ^m	2 ^m	1 ^m	0 ^m	sec.			

	0 ^m	1 ^m	2 ^m	3 ^m	4 ^m	5 ^m	6 ^m	7 ^m	8 ^m	9 ^m	
	90 deg.				91 deg.				92 deg.		
sec.	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	sec.
0	9.698970	9.700860	9.702743	9.704618	9.706484	9.708342	9.710192	9.712034	9.713868	9.715694	60
1	699001	700892	702775	704649	706515	708373	710223	712065	713899	715724	59
2	699033	700924	702806	704680	706546	708404	710254	712095	713929	715755	58
3	699065	700955	702837	704711	706577	708435	710284	712126	713960	715785	57
4	699096	700987	702869	704743	706608	708466	710315	712157	713990	715816	56
5	699128	701018	702900	704774	706639	708497	710346	712187	714021	715846	55
6	699159	701049	702931	704805	706670	708528	710377	712218	714051	715876	54
7	699191	701081	702962	704836	706701	708558	710408	712249	714082	715907	53
8	699223	701112	702994	704867	706732	708589	710438	712279	714112	715937	52
9	699254	701144	703025	704898	706763	708620	710469	712310	714143	715967	51
10	699286	701175	703056	704929	706794	708651	710500	712340	714173	715998	50
11	699317	701207	703087	704961	706825	708682	710531	712371	714204	716028	49
12	699349	701238	703119	704992	706856	708713	710561	712402	714234	716058	48
13	699380	701269	703150	705023	706887	708744	710592	712432	714264	716089	47
14	699412	701301	703182	705054	706918	708775	710623	712463	714295	716119	46
15	699443	701332	703213	705085	706949	708805	710653	712493	714325	716149	45
16	699475	701364	703244	705116	706980	708836	710684	712524	714356	716180	44
17	699506	701395	703275	705147	707011	708867	710715	712555	714386	716210	43
18	699538	701426	703307	705179	707042	708898	710746	712585	714417	716240	42
19	699569	701458	703338	705210	707073	708929	710776	712616	714447	716271	41
20	699601	701489	703369	705241	707104	708960	710807	712646	714478	716301	40
21	699633	701521	703400	705272	707135	708991	710838	712676	714508	716331	39
22	699664	701552	703432	705303	707166	709022	710869	712707	714539	716362	38
23	699696	701583	703463	705334	707197	709052	710899	712738	714569	716392	37
24	699727	701615	703494	705365	707228	709083	710930	712769	714600	716422	36
25	699759	701646	703525	705396	707259	709114	710961	712799	714630	716453	35
26	699790	701678	703557	705428	707290	709145	710991	712830	714660	716483	34
27	699822	701709	703588	705459	707321	709176	711022	712860	714691	716513	33
28	699853	701740	703619	705490	707352	709207	711053	712891	714721	716544	32
29	699885	701772	703650	705521	707383	709237	711084	712922	714752	716574	31
30	699916	701803	703682	705552	707414	709268	711114	712952	714782	716604	30
31	699948	701834	703713	705583	707445	709299	711145	712983	714813	716634	29
32	699979	701866	703744	705614	707476	709330	711176	713013	714843	716665	28
33	700011	701897	703775	705645	707507	709361	711206	713044	714873	716695	27
34	700042	701929	703807	705676	707538	709392	711237	713074	714904	716725	26
35	700074	701960	703838	705707	707569	709422	711268	713105	714934	716756	25
36	700105	701991	703869	705739	707600	709453	711298	713136	714965	716786	24
37	700137	702023	703900	705770	707631	709484	711329	713166	714995	716816	23
38	700168	702054	703932	705801	707662	709515	711360	713197	715026	716846	22
39	700200	702085	703963	705832	707693	709546	711391	713227	715056	716877	21
40	700231	702117	703994	705863	707724	709576	711421	713258	715086	716907	20
41	700263	702148	704025	705894	707755	709607	711452	713288	715117	716937	19
42	700294	702180	704056	705925	707786	709638	711482	713319	715147	716968	18
43	700326	702211	704087	705956	707817	709669	711513	713349	715178	716998	17
44	700357	702242	704119	705987	707848	709700	711544	713380	715208	717028	16
45	700389	702273	704150	706018	707878	709730	711574	713410	715238	717058	15
46	700420	702305	704181	706049	707909	709761	711605	713441	715269	717089	14
47	700452	702336	704212	706080	707940	709792	711636	713471	715299	717119	13
48	700483	702368	704244	706112	707971	709823	711666	713502	715330	717149	12
49	700515	702399	704275	706143	708002	709854	711697	713533	715360	717179	11
50	700546	702430	704306	706174	708033	709884	711728	713563	715390	717210	10
51	700578	702461	704337	706205	708064	709915	711758	713594	715421	717240	9
52	700609	702493	704368	706236	708095	709946	711789	713624	715451	717270	8
53	700641	702524	704399	706267	708126	709977	711820	713655	715481	717300	7
54	700672	702556	704431	706298	708157	710008	711850	713685	715512	717331	6
55	700703	702587	704462	706329	708188	710038	711881	713716	715542	717361	5
56	700735	702618	704493	706360	708219	710069	711912	713746	715573	717391	4
57	700766	702649	704524	706391	708249	710100	711942	713777	715603	717421	3
58	700798	702681	704556	706422	708280	710131	711973	713807	715633	717452	2
59	700829	702712	704587	706453	708311	710161	712004	713838	715664	717482	1
60	700860	702743	704618	706484	708342	710192	712034	713868	715694	717512	0
	59 ^m	58 ^m	57 ^m	56 ^m	55 ^m	54 ^m	53 ^m	52 ^m	51 ^m	50 ^m	sec.

sec.	10 ^m		11 ^m	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m	sec.	
	92 deg.		93 deg.					94 deg.					
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'			
0	0	9.717512	9.719322	9.721124	9.722919	9.724705	9.726484	9.728255	9.730018	9.731773	9.733520	60	
1	15	717542	719350	721154	722949	724735	726513	728284	730047	731803	733551	59	
2	30	717573	719382	721184	722978	724765	726543	728314	730077	731832	733580	58	
3	45	717603	719413	721214	723008	724794	726573	728343	730106	731861	733609	57	
4	0	9.717633	9.719443	9.721244	9.723038	9.724824	9.726602	9.728373	9.730135	9.731890	9.733638	56	
5	15	717663	719473	721274	723068	724854	726632	728402	730165	731920	733667	55	
6	30	717694	719503	721304	723098	724883	726661	728432	730194	731949	733696	54	
7	45	717724	719533	721334	723128	724913	726691	728461	730223	731978	733725	53	
8	0	9.717754	9.719563	9.721364	9.723157	9.724943	9.726721	9.728490	9.730253	9.732007	9.733754	52	
9	15	717784	719593	721394	723187	724973	726750	728520	730282	732036	733783	51	
10	30	717814	719623	721424	723217	725002	726780	728549	730311	732066	733812	50	
11	45	717845	719653	721454	723247	725032	726809	728579	730341	732095	733841	49	
12	0	9.717875	9.719683	9.721484	9.723277	9.725062	9.726839	9.728608	9.730370	9.732124	9.733870	48	
13	15	717905	719713	721514	723306	725091	726868	728638	730399	732153	733899	47	
14	30	717935	719743	721544	723336	725121	726898	728667	730428	732182	733928	46	
15	45	717965	719773	721574	723366	725151	726927	728696	730458	732211	733957	45	
16	0	9.717996	9.719804	9.721604	9.723396	9.725180	9.726957	9.728726	9.730487	9.732241	9.733986	44	
17	15	718026	719834	721634	723426	725210	726986	728755	730516	732270	734015	43	
18	30	718056	719864	721664	723456	725240	727016	728785	730546	732299	734044	42	
19	45	718086	719894	721693	723485	725269	727046	728814	730575	732328	734073	41	
20	0	9.718116	9.719924	9.721723	9.723515	9.725299	9.727075	9.728844	9.730604	9.732357	9.734102	40	
21	15	718147	719954	721753	723545	725329	727105	728873	730633	732386	734131	39	
22	30	718177	719984	721783	723575	725358	727134	728902	730663	732415	734161	38	
23	45	718207	720014	721813	723604	725388	727164	728932	730692	732445	734189	37	
24	0	9.718237	9.720044	9.721843	9.723634	9.725418	9.727193	9.728961	9.730721	9.732474	9.734219	36	
25	15	718267	720074	721873	723664	725447	727223	728991	730751	732503	734247	35	
26	30	718297	720104	721903	723694	725477	727252	729020	730780	732532	734277	34	
27	45	718328	720134	721933	723724	725507	727282	729049	730809	732561	734306	33	
28	0	9.718358	9.720164	9.721963	9.723753	9.725536	9.727311	9.729079	9.730838	9.732590	9.734335	32	
29	15	718388	720194	721993	723783	725566	727341	729108	730868	732619	734364	31	
30	30	718418	720224	722023	723813	725596	727370	729138	730897	732649	734393	30	
31	45	718448	720254	722052	723843	725625	727400	729167	730926	732678	734422	29	
32	0	9.718479	9.720284	9.722082	9.723873	9.725655	9.727429	9.729196	9.730955	9.732707	9.734451	28	
33	15	718509	720314	722112	723902	725684	727459	729226	730985	732736	734480	27	
34	30	718539	720344	722142	723932	725714	727488	729255	731014	732765	734509	26	
35	45	718569	720374	722172	723962	725744	727518	729284	731043	732794	734538	25	
36	0	9.718599	9.720404	9.722202	9.723992	9.725773	9.727547	9.729314	9.731072	9.732823	9.734567	24	
37	15	718629	720435	722232	724021	725803	727577	729343	731102	732852	734596	23	
38	30	718659	720465	722262	724051	725833	727606	729373	731131	732882	734625	22	
39	45	718689	720495	722292	724081	725862	727636	729402	731160	732911	734653	21	
40	0	9.718720	9.720525	9.722322	9.724111	9.725892	9.727665	9.729431	9.731189	9.732940	9.734683	20	
41	15	718750	720555	722351	724140	725922	727695	729461	731219	732969	734711	19	
42	30	718780	720585	722381	724170	725951	727724	729490	731248	732998	734741	18	
43	45	718810	720615	722411	724200	725981	727754	729519	731277	733027	734769	17	
44	0	9.718840	9.720645	9.722441	9.724230	9.726010	9.727783	9.729549	9.731306	9.733056	9.734798	16	
45	15	718870	720675	722471	724259	726040	727813	729578	731335	733085	734827	15	
46	30	718901	720705	722501	724289	726070	727842	729607	731365	733114	734856	14	
47	45	718931	720735	722531	724319	726099	727872	729637	731394	733143	734885	13	
48	0	9.718961	9.720765	9.722561	9.724349	9.726129	9.727901	9.729666	9.731423	9.733173	9.734914	12	
49	15	718991	720795	722590	724378	726158	727931	729695	731452	733202	734943	11	
50	30	719021	720825	722620	724408	726188	727960	729725	731482	733231	734972	10	
51	45	719051	720855	722650	724438	726218	727990	729754	731511	733260	735001	9	
52	0	9.719081	9.720885	9.722680	9.724468	9.726247	9.728019	9.729784	9.731540	9.733289	9.735030	8	
53	15	719111	720915	722710	724497	726276	728049	729813	731569	733318	735059	7	
54	30	719142	720945	722740	724527	726306	728078	729842	731598	733347	735088	6	
55	45	719172	720975	722770	724557	726336	728108	729871	731628	733376	735117	5	
56	0	9.719202	9.721005	9.722799	9.724586	9.726366	9.728137	9.729901	9.731657	9.733405	9.735146	4	
57	15	719232	721034	722829	724616	726395	728167	729930	731681	733434	735175	3	
58	30	719262	721064	722859	724646	726425	728196	729960	731715	733463	735204	2	
59	45	719292	721094	722889	724676	726454	728225	729989	731744	733492	735233	1	
60	0	9.719322	9.721124	9.722919	9.724705	9.726484	9.728255	9.730018	9.731773	9.733520	9.735262	0	
sec.	49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m	sec.		

17 Hours.

sec.	30 ^m		31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m	sec.	
	97 deg.		98 deg.					99 deg.					
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'			
0	9.752261	9.753909	9.755560	9.757203	9.758840	9.760469	9.762091	9.763706	9.765314	9.766914	9.768514	60	
1	752278	753936	755587	757231	758867	760496	762118	763733	765341	766941	768541	59	
2	752306	753964	755615	757258	758894	760523	762145	763760	765367	766968	768568	58	
3	752333	753992	755642	757285	758921	760550	762172	763786	765394	766995	768595	57	
4	31'	46'	1'	16'	31'	46'	1'	16'	31'	46'	1'	56	
0	9.752361	9.754019	9.755670	9.757313	9.758949	9.760577	9.762199	9.763813	9.765421	9.767021	9.768621	56	
5	752389	754047	755697	757340	758976	760604	762226	763840	765447	767047	768647	55	
6	752417	754074	755724	757367	759003	760632	762253	763867	765474	767074	768674	54	
7	752444	754102	755752	757395	759030	760659	762280	763894	765501	767101	768701	53	
8	32'	47'	2'	17'	32'	47'	2'	17'	32'	47'	2'	52	
0	9.752472	9.754129	9.755779	9.757422	9.759057	9.760686	9.762307	9.763921	9.765528	9.767127	9.768727	52	
9	752500	754157	755807	757449	759085	760713	762334	763948	765554	767154	768754	51	
10	752528	754184	755834	757477	759112	760740	762361	763974	765581	767180	768780	50	
11	752555	754212	755862	757504	759139	760767	762388	764001	765608	767207	768807	49	
12	33'	48'	3'	18'	33'	48'	3'	18'	33'	48'	3'	48	
0	9.752583	9.754239	9.755889	9.757531	9.759166	9.760794	9.762415	9.764028	9.765634	9.767234	9.768834	48	
13	752610	754267	755916	757559	759193	760821	762442	764055	765661	767260	768860	47	
14	752638	754295	755944	757586	759221	760848	762468	764082	765688	767287	768887	46	
15	752676	754322	755971	757613	759248	760875	762495	764109	765714	767313	768913	45	
16	34'	49'	4'	19'	34'	49'	4'	19'	34'	49'	4'	44	
0	9.752694	9.754350	9.755999	9.757640	9.759275	9.760902	9.762522	9.764135	9.765741	9.767341	9.768941	44	
17	752721	754377	756026	757668	759302	760929	762549	764162	765768	767367	768967	43	
18	752749	754405	756054	757695	759329	760956	762576	764189	765795	767393	768993	42	
19	752776	754432	756081	757722	759356	760983	762603	764216	765821	767420	769020	41	
20	35'	50'	5'	20'	35'	50'	5'	20'	35'	50'	5'	40	
0	9.752804	9.754460	9.756108	9.757750	9.759384	9.761010	9.762630	9.764243	9.765849	9.767446	9.769046	40	
21	752832	754487	756136	757777	759411	761038	762657	764269	765875	767473	769073	39	
22	752859	754515	756163	757804	759438	761065	762684	764296	765901	767499	769099	38	
23	752887	754542	756191	757831	759465	761092	762711	764323	765928	767526	769126	37	
24	36'	51'	6'	21'	36'	51'	6'	21'	36'	51'	6'	36	
0	9.752915	9.754570	9.756218	9.757859	9.759492	9.761119	9.762738	9.764350	9.765955	9.767553	9.769153	36	
25	752942	754597	756245	757886	759519	761146	762765	764377	765981	767579	769179	35	
26	752970	754625	756273	757913	759547	761173	762792	764403	766008	767606	769206	34	
27	752998	754653	756300	757941	759574	761200	762819	764430	766035	767633	769233	33	
28	37'	52'	7'	22'	37'	52'	7'	22'	37'	52'	7'	32	
0	9.753025	9.754680	9.756328	9.757968	9.759601	9.761227	9.762846	9.764457	9.766062	9.767665	9.769265	32	
29	753053	754708	756356	757995	759628	761254	762872	764484	766088	767689	769289	31	
30	753081	754735	756382	758022	759655	761281	762899	764511	766115	767712	769312	30	
31	753108	754763	756410	758050	759682	761308	762926	764537	766142	767739	769339	29	
32	38'	53'	8'	23'	38'	53'	8'	23'	38'	53'	8'	28	
0	9.753136	9.754790	9.756437	9.758077	9.759710	9.761335	9.762953	9.764564	9.766169	9.767768	9.769368	28	
33	753163	754818	756465	758104	759737	761362	762980	764591	766195	767792	769392	27	
34	753191	754845	756492	758132	759764	761389	763007	764618	766222	767818	769418	26	
35	753219	754873	756519	758159	759791	761416	763034	764645	766248	767845	769445	25	
36	39'	54'	9'	24'	39'	54'	9'	24'	39'	54'	9'	24	
0	9.753246	9.754900	9.756547	9.758186	9.759818	9.761443	9.763061	9.764671	9.766275	9.767871	9.769471	24	
37	753274	754928	756574	758213	759845	761470	763088	764698	766302	767898	769498	23	
38	753302	754955	756602	758241	759872	761497	763115	764724	766328	767924	769524	22	
39	753329	754983	756629	758268	759899	761524	763142	764751	766355	767951	769551	21	
40	40'	55'	10'	25'	40'	55'	10'	25'	40'	55'	10'	20	
0	9.753357	9.755010	9.756656	9.758295	9.759927	9.761551	9.763168	9.764779	9.766382	9.767978	9.769578	20	
41	753384	755038	756684	758322	759954	761578	763195	764805	766408	768004	769604	19	
42	753412	755065	756711	758350	759981	761605	763222	764832	766435	768031	769631	18	
43	753440	755093	756738	758377	760008	761632	763249	764859	766462	768057	769657	17	
44	41'	56'	11'	26'	41'	56'	11'	26'	41'	56'	11'	16	
0	9.753467	9.755120	9.756766	9.758404	9.760035	9.761659	9.763276	9.764886	9.766488	9.768084	9.769684	16	
45	753495	755148	756793	758431	760062	761686	763303	764912	766515	768110	769710	15	
46	753523	755175	756821	758459	760089	761713	763330	764939	766541	768137	769737	14	
47	753550	755203	756848	758487	760117	761740	763357	764966	766568	768163	769763	13	
48	42'	57'	12'	27'	42'	57'	12'	27'	42'	57'	12'	12	
0	9.753578	9.755230	9.756875	9.758513	9.760144	9.761767	9.763384	9.764993	9.766595	9.768190	9.769785	12	
49	753605	755258	756903	758540	760171	761794	763410	765019	766621	768216	769816	11	
50	753633	755285	756930	758568	760198	761821	763437	765046	766648	768243	769843	10	
51	753661	755313	756957	758595	760225	761848	763464	765073	766675	768269	769869	9	
52	43'	58'	13'	28'	43'	58'	13'	28'	43'	58'	13'	8	
0	9.753688	9.755340	9.756985	9.758622	9.760252	9.761875	9.763491	9.765100	9.766701	9.768296	9.769896	8	
53	753716	755367	757012	758649	760279	761902	763518	765126	766728	768327	769927	7	
54	753743	755395	757039	758676	760306	761929	763545	765153	766755	768349	769949	6	
55	753771	755422	757067	758704	760333	761956	763572	765180	766781	768375	769975	5	
56	44'	59'	14'	29'	44'	59'	14'	29'	44'	59'	14'	4	
0	9.753799	9.755450	9.757094	9.758731	9.760361	9.761983	9.763598	9.765207	9.766808	9.768402	9.769996	4	
57	753826	755477	757121	758758	760388	762010	763625	765233	766833	768428	769928	3	
58	753854	755505	757149	758785	760415	762037	763652	765260	766861	768455	769955	2	
59	753881	755532	757176	758813	760442	762064	763679	765287	766888	768481	769981	1	
60	9.753909	9.755560	9.757203	9.758840	9.760469	9.762091	9.763706	9.765314	9.766914	9.768514	9.769996	0	
	29 ^m	28 ^m	27 ^m	26 ^m	25 ^m	24 ^m	23 ^m	22 ^m	21 ^m	20 ^m		sec.	

		40 ^m	41 ^m	42 ^m	43 ^m	44 ^m	45 ^m	46 ^m	47 ^m	48 ^m	49 ^m		
		100 deg.				101 deg.				102 deg.			
sec	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	sec
0	9.768508	9.770094	9.771674	9.773247	9.774812	9.776371	9.777922	9.779467	9.781005	9.782536	9.784061	9.785586	60
1	15	768534	770121	771700	773273	774838	776397	777948	779493	781031	782562	784089	59
2	30	768561	770147	771727	773299	774864	776423	777974	779519	781056	782587	784114	58
3	45	768587	770174	771753	773325	774890	776448	778000	779544	781082	782613	784140	57
1'	16'	31'	46'	1'	16'	31'	46'	1'	16'	31'	46'	1'	sec
4	0	9.768614	9.770200	9.771779	9.773351	9.774916	9.776474	9.778026	9.779570	9.781107	9.782638	9.784165	56
5	15	768640	770226	771805	773377	774942	776500	778051	779596	781133	782663	784192	55
6	30	768667	770253	771832	773403	774968	776526	778077	779621	781159	782689	784218	54
7	45	768693	770279	771858	773429	774994	776552	778103	779647	781184	782715	784243	53
2'	17'	32'	47'	2'	17'	32'	47'	2'	17'	32'	47'	2'	sec
8	0	9.768720	9.770305	9.771884	9.773456	9.775020	9.776578	9.778129	9.779673	9.781210	9.782740	9.784267	52
9	15	768746	770332	771910	773482	775046	776604	778155	779698	781235	782765	784291	51
10	30	768773	770358	771937	773508	775072	776629	778180	779724	781261	782791	784320	50
11	45	768799	770385	771963	773534	775098	776656	778206	779750	781286	782816	784349	49
3'	18'	33'	48'	3'	18'	33'	48'	3'	18'	33'	48'	3'	sec
12	0	9.768826	9.770411	9.771989	9.773560	9.775124	9.776682	9.778232	9.779775	9.781312	9.782842	9.784368	48
13	15	768852	770437	772015	773586	775150	776707	778258	779801	781337	782867	784393	47
14	30	768879	770464	772042	773612	775176	776733	778284	779827	781363	782893	784422	46
15	45	768905	770490	772068	773639	775202	776759	778309	779852	781389	782918	784451	45
4'	19'	34'	49'	4'	19'	34'	49'	4'	19'	34'	49'	4'	sec
16	0	9.768932	9.770516	9.772094	9.773665	9.775228	9.776785	9.778335	9.779878	9.781414	9.782943	9.784470	44
17	15	768958	770543	772120	773691	775254	776811	778361	779904	781440	782969	784498	43
18	30	768985	770569	772147	773717	775280	776837	778387	779929	781465	782994	784527	42
19	45	769011	770595	772173	773743	775306	776863	778412	779955	781491	783020	784556	41
5'	20'	35'	50'	5'	20'	35'	50'	5'	20'	35'	50'	5'	sec
20	0	9.769038	9.770622	9.772199	9.773769	9.775332	9.776889	9.778438	9.779981	9.781516	9.783045	9.784572	40
21	15	769064	770648	772225	773795	775358	776915	778464	780006	781542	783070	784597	39
22	30	769090	770674	772251	773821	775384	776940	778490	780032	781567	783096	784626	38
23	45	769117	770701	772277	773847	775410	776966	778515	780057	781593	783121	784655	37
6'	21'	36'	51'	6'	21'	36'	51'	6'	21'	36'	51'	6'	sec
24	0	9.769143	9.770727	9.772304	9.773874	9.775436	9.776992	9.778541	9.780083	9.781618	9.783147	9.784675	36
25	15	769170	770753	772330	773900	775462	777018	778567	780109	781644	783173	784701	35
26	30	769196	770780	772356	773926	775488	777044	778593	780133	781670	783198	784730	34
27	45	769223	770806	772382	773952	775514	777070	778618	780160	781695	783223	784759	33
7'	22'	37'	52'	7'	22'	37'	52'	7'	22'	37'	52'	7'	sec
28	0	9.769249	9.770832	9.772409	9.773978	9.775540	9.777096	9.778644	9.780186	9.781721	9.783248	9.784775	32
29	15	769276	770859	772435	774004	775566	777122	778670	780211	781746	783274	784801	31
30	30	769302	770885	772461	774030	775592	777147	778696	780237	781772	783300	784830	30
31	45	769328	770911	772487	774056	775618	777173	778721	780263	781797	783325	784859	29
8'	23'	38'	53'	8'	23'	38'	53'	8'	23'	38'	53'	8'	sec
32	0	9.769355	9.770938	9.772514	9.774082	9.775644	9.777199	9.778747	9.780288	9.781823	9.783350	9.784877	28
33	15	769381	770964	772540	774108	775670	777225	778773	780314	781848	783377	784905	27
34	30	769408	770990	772566	774135	775696	777251	778799	780340	781874	783403	784932	26
35	45	769434	771017	772592	774161	775722	777277	778824	780365	781899	783426	784960	25
9'	24'	39'	54'	9'	24'	39'	54'	9'	24'	39'	54'	9'	sec
36	0	9.769461	9.771043	9.772618	9.774187	9.775748	9.777303	9.778850	9.780391	9.781925	9.783452	9.784979	24
37	15	769487	771069	772644	774213	775774	777328	778876	780416	781950	783477	785004	23
38	30	769514	771096	772671	774239	775800	777354	778902	780442	781976	783502	785029	22
39	45	769540	771122	772697	774265	775826	777380	778927	780468	782001	783528	785055	21
10'	25'	40'	55'	10'	25'	40'	55'	10'	25'	40'	55'	10'	sec
40	0	9.769566	9.771148	9.772723	9.774291	9.775852	9.777406	9.778953	9.780493	9.782027	9.783553	9.785079	20
41	15	769593	771174	772749	774317	775878	777432	778979	780519	782052	783579	785105	19
42	30	769619	771201	772776	774343	775904	777458	779005	780545	782078	783604	785131	18
43	45	769646	771227	772802	774369	775930	777483	779030	780570	782103	783629	785158	17
11'	26'	41'	56'	11'	26'	41'	56'	11'	26'	41'	56'	11'	sec
44	0	9.769672	9.771253	9.772828	9.774395	9.775956	9.777509	9.779056	9.780596	9.782129	9.783655	9.785181	16
45	15	769698	771280	772854	774421	775982	777535	779082	780621	782154	783680	785206	15
46	30	769725	771306	772880	774447	776008	777561	779107	780647	782180	783706	785232	14
47	45	769751	771332	772906	774473	776034	777587	779133	780672	782205	783731	785258	13
12'	27'	42'	57'	12'	27'	42'	57'	12'	27'	42'	57'	12'	sec
48	0	9.769778	9.771359	9.772933	9.774500	9.776060	9.777613	9.779159	9.780698	9.782231	9.783758	9.785285	12
49	15	769804	771385	772959	774526	776085	777638	779185	780724	782256	783782	785308	11
50	30	769831	771411	772985	774551	776111	777664	779210	780749	782282	783807	785333	10
51	45	769857	771437	773011	774578	776137	777690	779236	780775	782307	783832	785358	9
13'	28'	43'	58'	13'	28'	43'	58'	13'	28'	43'	58'	13'	sec
52	0	9.769883	9.771464	9.773037	9.774604	9.776163	9.777716	9.779262	9.780801	9.782333	9.783858	9.785383	8
53	15	769910	771490	773063	774630	776189	777742	779287	780826	782358	783883	785408	7
54	30	769936	771516	773090	774656	776215	777768	779313	780852	782383	783908	785434	6
55	45	769962	771543	773116	774682	776241	777793	779339	780877	782409	783934	785460	5
14'	29'	44'	59'	14'	29'	44'	59'	14'	29'	44'	59'	14'	sec
56	0	9.769989	9.771569	9.773142	9.774708	9.776267	9.777819	9.779364	9.780903	9.782434	9.783959	9.785484	4
57	15	770015	771595	773168	774734	776293	777845	779390	780928	782460	783984	785509	3
58	30	770042	771621	773194	774760	776319	777871	779416	780954	782485	784010	785535	2
59	45	770068	771648	773220	774786	776345	777897	779441	780980	782511	784035	785560	1
60	60	9.770094	9.771674	9.773247	9.774812	9.776371	9.777922	9.779467	9.781005	9.782536	9.784061	9.785586	0
sec	19 ^m	18 ^m	17 ^m	16 ^m	15 ^m	14 ^m	13 ^m	12 ^m	11 ^m	10 ^m	9 ^m	8 ^m	sec

N.P.C.	50 ^m		51 ^m		52 ^m		53 ^m		54 ^m		55 ^m		56 ^m		57 ^m		58 ^m		59 ^m		N.P.C.
	102 deg.		103 deg.		104 deg.		105 deg.		106 deg.		107 deg.		108 deg.		109 deg.		110 deg.		111 deg.		
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	
0	9.784061	9.785578	9.787089	9.788593	9.790090	9.791580	9.793064	9.794541	9.796012	9.797476	9.798933	9.799386	9.799836	9.799283	9.799729	9.799172	9.798612	9.798050	9.797486	9.796920	60
1	15	784086	785603	787114	788618	790115	791605	793089	794566	796036	797500	798959	799404	799845	799283	798719	798153	797586	797017	796446	59
2	30	784111	785629	787139	788643	790140	791630	793114	794591	796061	797525	798984	799429	799869	799307	798742	798175	797607	797037	796465	58
3	45	784137	785654	787164	788668	790165	791655	793138	794615	796085	797549	798999	799434	799864	799292	798726	798158	797589	797019	796447	57
4	0	9.784162	9.785679	9.787189	9.788693	9.790189	9.791680	9.793163	9.794640	9.796110	9.797573	9.799032	9.799486	9.799936	9.799383	9.798828	9.798271	9.797713	9.797154	9.796594	56
5	15	784187	785704	787214	788718	790214	791704	793188	794664	796134	797598	799057	799501	799940	799378	798814	798249	797683	797116	796548	55
6	30	784213	785729	787239	788743	790239	791729	793214	794689	796159	797622	799081	799525	799964	799402	798837	798271	797704	797136	796567	54
7	45	784238	785755	787264	788768	790264	791754	793237	794713	796183	797646	799105	799549	799988	799426	798861	798294	797726	797157	796587	53
8	0	9.784263	9.785780	9.787290	9.788793	9.790289	9.791779	9.793262	9.794738	9.796208	9.797671	9.799129	9.799582	9.799929	9.799375	9.798820	9.798264	9.797707	9.797149	9.796590	52
9	15	784289	785806	787315	788818	790314	791803	793286	794762	796232	797695	799154	799607	799944	799381	798816	798250	797683	797115	796546	51
10	30	784314	785830	787340	788843	790339	791828	793311	794787	796256	797719	799178	799631	799968	799405	798840	798273	797706	797138	796569	50
11	45	784339	785855	787365	788868	790364	791853	793336	794812	796281	797744	799203	799656	799993	799430	798865	798298	797731	797163	796594	49
12	0	9.784363	9.785881	9.787390	9.788893	9.790389	9.791878	9.793360	9.794836	9.796305	9.797768	9.799227	9.799680	9.799927	9.799373	9.798818	9.798262	9.797705	9.797147	9.796588	48
13	15	784390	785906	787415	788918	790413	791902	793385	794861	796330	797792	799251	799704	799941	799378	798813	798247	797680	797112	796543	47
14	30	784415	785931	787440	788943	790438	791927	793410	794885	796354	797817	799276	799729	799966	799403	798838	798271	797704	797136	796567	46
15	45	784440	785956	787465	788968	790463	791952	793434	794910	796379	797842	799301	799754	799991	799428	798863	798296	797729	797161	796592	45
16	0	9.784466	9.785982	9.787490	9.788993	9.790488	9.791977	9.793459	9.794934	9.796403	9.797866	9.799325	9.799778	9.799925	9.799369	9.798814	9.798258	9.797701	9.797143	9.796584	44
17	15	784491	786007	787515	789018	790513	792001	793483	794959	796427	797890	799349	799802	799939	799385	798830	798273	797716	797158	796599	43
18	30	784517	786032	787541	789043	790538	792026	793508	794983	796452	797914	799373	799826	799963	799409	798854	798297	797740	797182	796623	42
19	45	784542	786057	787566	789067	790563	792051	793533	795008	796476	797938	799397	799850	799987	799433	798878	798321	797764	797206	796647	41
20	0	9.784567	9.786082	9.787591	9.789093	9.790588	9.792076	9.793557	9.795032	9.796501	9.797964	9.799423	9.799876	9.799923	9.799369	9.798814	9.798258	9.797701	9.797143	9.796584	40
21	15	784592	786107	787616	789117	790612	792100	793582	795057	796525	797987	799446	799899	799936	799382	798827	798270	797713	797155	796596	39
22	30	784618	786133	787641	789142	790637	792125	793607	795081	796550	798011	799470	799923	799960	799406	798851	798294	797737	797179	796620	38
23	45	784643	786158	787666	789167	790662	792150	793631	795106	796574	798035	799494	799947	799984	799430	798875	798318	797758	797200	796641	37
24	0	9.784668	9.786183	9.787691	9.789192	9.790687	9.792175	9.793656	9.795130	9.796598	9.798060	9.799519	9.799972	9.799909	9.799355	9.798800	9.798243	9.797686	9.797128	9.796569	36
25	15	784694	786208	787716	789217	790712	792199	793681	795155	796623	798084	799543	799996	799933	799379	798824	798267	797710	797152	796593	35
26	30	784719	786234	787741	789242	790737	792224	793705	795180	796647	798108	799567	799920	799957	799403	798848	798291	797734	797176	796617	34
27	45	784744	786259	787766	789267	790761	792249	793730	795204	796672	798133	799592	799945	799982	799428	798873	798316	797755	797197	796638	33
28	0	9.784770	9.786284	9.787791	9.789292	9.790786	9.792274	9.793754	9.795229	9.796696	9.798157	9.799618	9.799971	9.799908	9.799354	9.798800	9.798243	9.797686	9.797128	9.796569	32
29	15	784795	786309	787816	789317	790811	792298	793779	795253	796720	798181	799642	799995	799932	799378	798823	798266	797709	797151	796592	31
30	30	784820	786334	787842	789342	790836	792323	793804	795278	796745	798206	799667	799920	799957	799403	798848	798291	797734	797176	796617	30
31	45	784845	786359	787867	789367	790861	792348	793828	795302	796769	798230	799691	799944	799981	799427	798872	798315	797758	797200	796641	29
32	0	9.784871	9.786385	9.787892	9.789392	9.790886	9.792373	9.793853	9.795327	9.796794	9.798254	9.799715	9.799968	9.799905	9.799351	9.798796	9.798239	9.797682	9.797124	9.796565	28
33	15	784896	786410	787917	789417	790911	792397	793878	795351	796818	798278	799739	799992	799929	799375	798820	798263	797706	797148	796589	27
34	30	784921	786435	787942	789442	790935	792422	793902	795376	796842	798303	799764	799917	799954	799400	798845	798288	797731	797173	796614	26
35	45	784946	786460	787967	789467	790960	792447	793927	795400	796867	798327	799788	799941	799978	799424	798869	798312	797755	797197	796635	25
36	0	9.784972	9.786485	9.787992	9.789492	9.790985	9.792472	9.793951	9.795425	9.796891	9.798351	9.799812	9.799965	9.799902	9.799348	9.798793	9.798236	9.797679	9.797121	9.796562	24
37	15	784997	786510	788017	789517	791010	792496	793976	795449	796916	798376	799837	799990	799927	799373	798818	798261	797704	797146	796587	23
38	30	785022	786536	788042	789542	791035	792521	794001	795474	796940	798401	799862	799915	799952	799398	798843	798286	797729	797171	796612	22
39	45	785048	786561	788067	789567	791059	792546	794025	795498	796964	798424	799885	799938	799975	799421	798866	798309	797752	797194	796635	21
40	0	9.785073	9.786586	9.788092	9.789592	9.791084	9.792570	9.794050	9.795523	9.796989	9.798448	9.799907	9.799960	9.799897	9.799343	9.798788	9.798231	9.797674	9.797116	9.796557	20
41	15	785098	786611	788117	789617	791109	792595	794074	795547	797013	798473	799934	799987	799924	799370	798815	798258	797701	797143	796584	19
42	30	785124	786636	788142	789641	791133	792620	794099	795572	797037	798497	799958	799911	799948	799394	798839	798282	797725	797167	796608	18
43	45	785149	786661	788167	789666	791159	792644	794124	795596	797062	798521	7									

	0 ^m	1 ^m	2 ^m	3 ^m	4 ^m	5 ^m	6 ^m	7 ^m	8 ^m	9 ^m	
105 deg.					106 deg.				107 deg.		
sec.	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	sec.
0	9.798933	9.800384	9.801828	9.803266	9.804697	9.806122	9.807540	9.808952	9.810357	9.811756	60
15	798958	800408	801852	803290	804721	806146	807564	808975	810381	811780	59
30	798982	800432	801876	803314	804745	806169	807587	808999	810404	811803	58
45	799006	800456	801900	803338	804769	806193	807611	809022	810428	811826	57
	1'	16'	31'	46'	1'	16'	31'	46'	1'	16'	
4	9.799030	9.800481	9.801924	9.803362	9.804792	9.806217	9.807635	9.809046	9.810451	9.811849	56
5	799054	800505	801948	803386	804816	806240	807658	809069	810474	811873	55
6	799079	800529	801972	803409	804840	806264	807682	809093	810498	811896	54
7	799103	800553	801996	803433	804864	806288	807705	809116	810521	811919	53
	2'	17'	32'	47'	2'	17'	32'	47'	2'	17'	
8	9.799127	9.800577	9.802020	9.803457	9.804888	9.806311	9.807729	9.809140	9.810544	9.811943	52
9	799151	800601	802044	803481	804911	806335	807752	809163	810568	811966	51
10	799176	800625	802068	803505	804935	806359	807776	809187	810591	811989	50
11	799200	800649	802092	803529	804959	806382	807800	809210	810614	812012	49
	3'	18'	33'	48'	3'	18'	33'	48'	3'	18'	
12	9.799224	9.800673	9.802116	9.803553	9.804983	9.806406	9.807823	9.809234	9.810638	9.812035	48
13	799248	800698	802140	803577	805006	806430	807847	809257	810661	812059	47
14	799272	800722	802164	803601	805030	806453	807870	809281	810684	812082	46
15	799297	800746	802188	803624	805054	806477	807894	809304	810708	812105	45
	4'	19'	34'	49'	4'	19'	34'	49'	4'	19'	
16	9.799321	9.800770	9.802212	9.803648	9.805078	9.806501	9.807917	9.809327	9.810731	9.812128	44
17	799345	800794	802236	803672	805102	806524	807941	809351	810755	812152	43
18	799369	800818	802260	803696	805125	806548	807964	809374	810778	812175	42
19	799393	800842	802284	803720	805149	806572	807988	809398	810801	812198	41
	5'	20'	35'	50'	5'	20'	35'	50'	5'	20'	
20	9.799418	9.800866	9.802308	9.803744	9.805173	9.806595	9.808012	9.809421	9.810824	9.812221	40
21	799442	800890	802332	803768	805197	806619	808035	809445	810848	812245	39
22	799466	800914	802356	803792	805220	806643	808059	809468	810871	812268	38
23	799490	800938	802380	803815	805244	806666	808082	809491	810895	812291	37
	6'	21'	36'	51'	6'	21'	36'	51'	6'	21'	
24	9.799514	9.800963	9.802404	9.803839	9.805268	9.806690	9.808106	9.809515	9.810918	9.812314	36
25	799539	800987	802428	803863	805292	806714	808129	809538	810942	812337	35
26	799563	801011	802452	803887	805315	806737	808153	809562	810964	812361	34
27	799587	801035	802476	803911	805339	806761	808176	809585	810988	812384	33
	7'	22'	37'	52'	7'	22'	37'	52'	7'	22'	
28	9.799611	9.801059	9.802500	9.803935	9.805363	9.806785	9.808200	9.809609	9.811011	9.812407	32
29	799635	801083	802524	803959	805387	806808	808223	809633	811034	812430	31
30	799660	801107	802548	803982	805410	806832	808247	809656	811058	812454	30
31	799684	801131	802572	804006	805434	806856	808270	809679	811081	812477	29
	8'	23'	38'	53'	8'	23'	38'	53'	8'	23'	
32	9.799708	9.801155	9.802596	9.804030	9.805458	9.806879	9.808294	9.809702	9.811104	9.812500	28
33	799732	801179	802620	804054	805482	806903	808317	809726	811128	812523	27
34	799756	801203	802644	804078	805505	806926	808341	809749	811151	812546	26
35	799780	801227	802668	804102	805529	806949	808365	809773	811174	812570	25
	9'	24'	39'	54'	9'	24'	39'	54'	9'	24'	
36	9.799805	9.801251	9.802692	9.804126	9.805553	9.806974	9.808388	9.809796	9.811198	9.812593	24
37	799829	801275	802716	804150	805577	806997	808412	809819	811221	812616	23
38	799853	801300	802740	804173	805600	807021	808435	809843	811244	812639	22
39	799877	801324	802764	804197	805624	807045	808459	809866	811267	812662	21
	10'	25'	40'	55'	10'	25'	40'	55'	10'	25'	
40	9.799901	9.801348	9.802788	9.804221	9.805648	9.807068	9.808482	9.809890	9.811291	9.812686	20
41	799925	801372	802811	804245	805672	807092	808506	809913	811314	812709	19
42	799950	801396	802835	804269	805695	807115	808529	809936	811337	812732	18
43	799974	801420	802859	804292	805719	807139	808553	809960	811361	812755	17
	11'	26'	41'	56'	11'	26'	41'	56'	11'	26'	
44	9.799998	9.801444	9.802883	9.804316	9.805743	9.807163	9.808576	9.809983	9.811384	9.812778	16
45	800022	801468	802907	804340	805766	807186	808600	810007	811407	812801	15
46	800046	801492	802931	804364	805790	807210	808623	810030	811431	812825	14
47	800070	801516	802955	804388	805814	807233	808647	810053	811454	812848	13
	12'	27'	42'	57'	12'	27'	42'	57'	12'	27'	
48	9.800094	9.801540	9.802979	9.804412	9.805838	9.807257	9.808670	9.810077	9.811477	9.812871	12
49	800119	801564	803003	804435	805861	807281	808694	810100	811500	812894	11
50	800143	801588	803027	804459	805885	807304	808717	810124	811524	812917	10
51	800167	801612	803051	804483	805909	807328	808741	810147	811547	812941	9
	13'	28'	43'	58'	13'	28'	43'	58'	13'	28'	
52	9.800191	9.801636	9.803075	9.804507	9.805932	9.807351	9.808764	9.810170	9.811570	9.812964	8
53	800215	801660	803099	804531	805956	807375	808788	810194	811594	812987	7
54	800239	801684	803123	804554	805980	807399	808811	810217	811617	813010	6
55	800263	801708	803147	804578	806003	807422	808835	810241	811640	813033	5
	14'	29'	44'	59'	14'	29'	44'	59'	14'	29'	
56	9.800288	9.801732	9.803170	9.804602	9.806027	9.807446	9.808858	9.810264	9.811663	9.813056	4
57	800312	801756	803194	804626	806051	807469	808882	810287	811687	813080	3
58	800336	801780	803218	804650	806075	807493	808905	810311	811710	813103	2
59	800360	801804	803242	804673	806098	807517	808929	810334	811733	813126	1
60	800384	801828	803266	804697	806122	807540	808952	9.810357	9.811756	9.813149	0
sec.	59 ^m	58 ^m	57 ^m	56 ^m	55 ^m	54 ^m	53 ^m	52 ^m	51 ^m	50 ^m	sec.

SEC.	10 ^m		11 ^m		12 ^m		13 ^m		14 ^m		15 ^m		16 ^m		17 ^m		18 ^m		19 ^m		SEC.
	107 deg.				108 deg.				109 deg.												
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'			
0	0	9.813149	9.814535	9.815915	9.817289	9.818656	9.820017	9.821372	9.822721	9.824063	9.825399	60									
1	15	813172	814558	815938	817312	818679	820040	821394	822743	824085	825421	59									
2	30	813195	814581	815961	817335	818702	820063	821417	822765	824108	825444	58									
3	45	813218	814604	815984	817357	818724	820085	821440	822788	824130	825466	57									
4	0	31'	46'	1'	16'	31'	46'	1'	16'	31'	46'										
5	15	813242	9.814628	9.816007	9.817380	9.818747	9.820108	9.821462	9.822810	9.824152	9.825488	56									
6	30	813265	814651	816030	817403	818770	820130	821485	822833	824174	825510	55									
7	45	813288	814674	816053	817426	818793	820153	821507	822855	824197	825532	54									
8	0	32'	47'	2'	17'	32'	47'	2'	17'	32'	47'										
9	15	813311	814697	816076	817449	818815	820176	821530	822877	824219	825554	53									
10	30	9.813334	9.814720	9.816099	9.817472	9.818838	9.820198	9.821552	9.822900	9.824241	9.825577	52									
11	45	813357	814743	816122	817495	818861	820221	821575	822922	824264	825599	51									
12	0	33'	48'	3'	18'	33'	48'	3'	18'	33'	48'										
13	15	813381	814766	816145	817517	818884	820244	821597	822945	824286	825621	50									
14	30	813404	814789	816168	817540	818906	820266	821620	822967	824308	825643	49									
15	45	813427	814812	816191	817563	818929	820289	821642	822990	9.824331	9.825666	48									
16	0	34'	49'	4'	19'	34'	49'	4'	19'	34'	49'										
17	15	813450	814835	816214	817586	818952	820311	821665	823012	824353	825688	47									
18	30	813473	814858	816236	817609	818974	820334	821687	823034	824375	825710	46									
19	45	813496	814881	816259	817631	818997	820356	821710	823057	824397	825732	45									
20	0	35'	50'	5'	20'	35'	50'	5'	20'	35'	50'										
21	15	9.813612	9.814996	9.816374	9.817745	9.819111	9.820470	9.821822	9.823169	9.824509	9.825843	40									
22	30	813635	815019	816397	817768	819133	820492	821845	823191	824531	825863	39									
23	45	813658	815042	816420	817791	819156	820515	821867	823214	824554	825887	38									
24	0	36'	51'	6'	21'	36'	51'	6'	21'	36'	51'										
25	15	813704	9.815088	9.816465	9.817837	9.819201	9.820560	9.821912	9.823258	9.824598	9.825932	36									
26	30	813727	815111	816488	817859	819224	820582	821935	823281	824620	825954	35									
27	45	813751	815134	816511	817882	819247	820605	821957	823303	824643	825976	34									
28	0	37'	52'	7'	22'	37'	52'	7'	22'	37'	52'										
29	15	813797	9.815180	9.816557	9.817928	9.819292	9.820650	9.822002	9.823348	9.824687	9.826020	32									
30	30	813820	815203	816580	817950	819315	820673	822025	823370	824710	826043	31									
31	45	813843	815226	816603	817973	819338	820695	822047	823393	824732	826065	30									
32	0	38'	53'	8'	23'	38'	53'	8'	23'	38'	53'										
33	15	813866	815249	816626	817996	819360	820718	822070	823415	824754	826087	29									
34	30	9.813889	9.815272	9.816649	9.818019	9.819383	9.820741	9.822092	9.823437	9.824776	9.826109	28									
35	45	813912	815295	816671	818042	819405	820763	822115	823460	824799	826131	27									
36	0	39'	54'	9'	24'	39'	54'	9'	24'	39'	54'										
37	15	813935	815318	816694	818064	819428	820786	822137	823482	824821	826153	26									
38	30	813958	815341	816717	818087	819451	820808	822159	823504	824843	826176	25									
39	45	813982	815364	816740	818110	819474	820831	822182	823527	9.824865	9.826198	24									
40	0	40'	55'	10'	25'	40'	55'	10'	25'	40'	55'										
41	15	814005	815387	816763	818133	819496	820853	822204	823549	824888	826220	23									
42	30	814028	815410	816786	818156	819519	820876	822227	823571	824909	826242	22									
43	45	814051	815433	816809	818178	819542	820899	822249	823594	824932	826264	21									
44	0	41'	56'	11'	26'	41'	56'	11'	26'	41'	56'										
45	15	814166	9.815548	9.816923	9.818292	9.819655	9.821011	9.822362	9.823706	9.825043	9.826375	16									
46	30	814189	815571	816946	818315	819678	821034	822384	823728	825068	826397	15									
47	45	814212	815594	816969	818338	819700	821057	822407	823750	825088	826419	14									
48	0	42'	57'	12'	27'	42'	57'	12'	27'	42'	57'										
49	15	814259	9.815640	9.817015	9.818383	9.819746	9.821102	9.822451	9.823795	9.825132	9.826464	12									
50	30	814282	815663	817037	818406	819768	821124	822474	823817	825153	826486	11									
51	45	814305	815686	817060	818429	819791	821147	822496	823840	825177	826508	10									
52	0	43'	58'	13'	28'	43'	58'	13'	28'	43'	58'										
53	15	814351	9.815732	9.817106	9.818474	9.819836	9.821192	9.822541	9.823884	9.825221	9.826552	8									
54	30	814374	815755	817129	818497	819859	821214	822564	823907	825243	826574	7									
55	45	814397	815778	817152	818520	819881	821237	822586	823929	825266	826596	6									
56	0	44'	59'	14'	29'	44'	59'	14'	29'	44'	59'										
57	15	9.814443	9.815823	9.817198	9.818565	9.819927	9.821289	9.822631	9.823974	9.825310	9.826641	4									
58	30	814466	815846	817221	818588	819949	821304	822653	823996	825332	826663	3									
59	45	814489	815869	817243	818611	819972	821327	822676	824018	825355	826685	2									
60	0	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'										
1	15	814512	815892	817266	818633	819995	821349	822698	824041	825377	826707	1									
2	30	814535	9.815915	9.817289	9.818656	9.820017	9.821372	9.822721	9.824063	9.825399	9.826729	0									
SEC.		49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m										

sec.	20 ^m				21 ^m				22 ^m				23 ^m				24 ^m				25 ^m				26 ^m				27 ^m				28 ^m				29 ^m			
	110 deg.								111 deg.								112 deg.																							
0	0'	9.826729	9.828053	9.829370	9.830682	9.831987	9.833287	9.834580	9.835867	9.837148	9.838424	60	0'	9.826729	9.828053	9.829370	9.830682	9.831987	9.833287	9.834580	9.835867	9.837148	9.838424	60																
1	15	826751	828075	829392	830704	832009	833318	834601	835889	837170	838445	59	15	826751	828075	829392	830704	832009	833318	834601	835889	837170	838445	59																
2	30	826773	828097	829414	830726	832031	833330	834623	835910	837191	838466	58	30	826773	828097	829414	830726	832031	833330	834623	835910	837191	838466	58																
3	45	826795	828119	829436	830747	832053	833352	834645	835931	837212	838487	57	45	826795	828119	829436	830747	832053	833352	834645	835931	837212	838487	57																
4	0	1'	9.826817	9.828141	9.829458	9.830769	9.832074	9.833373	9.834666	9.835953	9.837234	9.838508	56	0	1'	9.826817	9.828141	9.829458	9.830769	9.832074	9.833373	9.834666	9.835953	9.837234	9.838508	56														
5	15	826840	828163	829480	830791	832096	833395	834687	835974	837255	838530	55	15	826840	828163	829480	830791	832096	833395	834687	835974	837255	838530	55																
6	30	826862	828185	829502	830813	832118	833416	834709	835996	837276	838551	54	30	826862	828185	829502	830813	832118	833416	834709	835996	837276	838551	54																
7	45	826884	828207	829524	830835	832139	833438	834731	836017	837297	838572	53	45	826884	828207	829524	830835	832139	833438	834731	836017	837297	838572	53																
8	0	2'	9.826906	9.828229	9.829546	9.830856	9.832161	9.833460	9.834752	9.836038	9.837319	9.838593	52	0	2'	9.826906	9.828229	9.829546	9.830856	9.832161	9.833460	9.834752	9.836038	9.837319	9.838593	52														
9	15	826928	828251	829568	830878	832183	833481	834773	836060	837340	838614	51	15	826928	828251	829568	830878	832183	833481	834773	836060	837340	838614	51																
10	30	826950	828273	829589	830900	832204	833503	834795	836081	837361	838636	50	30	826950	828273	829589	830900	832204	833503	834795	836081	837361	838636	50																
11	45	826972	828295	829611	830922	832226	833524	834816	836103	837383	838657	49	45	826972	828295	829611	830922	832226	833524	834816	836103	837383	838657	49																
12	0	3'	9.826994	9.828317	9.829633	9.830944	9.832248	9.833546	9.834838	9.836124	9.837404	9.838678	48	0	3'	9.826994	9.828317	9.829633	9.830944	9.832248	9.833546	9.834838																		

	30 ^m	31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m	
	112 deg.		113 deg.				114 deg.				
30 ^s	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	30 ^s
0	0.839693	9.840956	9.842213	9.843464	9.844710	9.845949	9.847183	9.848410	9.849632	9.850848	60
1	15	839714	840977	842234	843485	844731	845970	847203	848431	849653	59
2	30	839735	840998	842255	843506	844751	845999	847224	848451	849673	58
3	45	839756	841019	842276	843527	844772	846011	847244	848472	849693	57
4	0	9.839777	9.841040	9.842297	9.843548	9.844793	9.846032	9.847265	9.848492	9.849714	56
5	15	839798	841061	842318	843568	844813	846052	847285	848512	849734	55
6	30	839819	841082	842339	843589	844834	846073	847306	848533	849754	54
7	45	839840	841103	842359	843610	844855	846094	847326	848553	849774	53
8	0	9.839862	9.841124	9.842380	9.843631	9.844875	9.846114	9.847347	9.848574	9.849795	52
9	15	839883	841145	842401	843652	844896	846135	847367	848594	849815	51
10	30	839904	841166	842422	843672	844917	846156	847388	848615	849835	50
11	45	839925	841187	842443	843693	844938	846176	847408	848635	849856	49
12	0	9.839946	9.841208	9.842464	9.843714	9.844958	9.846196	9.847429	9.848655	9.849876	48
13	15	839967	841229	842485	843735	844979	846217	847449	848676	849896	47
14	30	839988	841250	842506	843756	845000	846238	847470	848696	849917	46
15	45	840009	841271	842527	843776	845020	846258	847490	848716	849937	45
16	0	9.840030	9.841292	9.842547	9.843797	9.845041	9.846279	9.847511	9.848737	9.849957	44
17	15	840051	841313	842568	843818	845062	846299	847531	848757	849977	43
18	30	840072	841334	842589	843839	845082	846320	847552	848778	849998	42
19	45	840093	841355	842610	843859	845103	846340	847572	848798	850018	41
20	0	9.840114	9.841376	9.842631	9.843880	9.845124	9.846361	9.847593	9.848818	9.850038	40
21	15	840136	841397	842652	843901	845144	846382	847613	848839	850058	39
22	30	840157	841418	842673	843922	845165	846402	847634	848859	850079	38
23	45	840178	841439	842694	843943	845186	846423	847654	848879	850099	37
24	0	9.840199	9.841460	9.842714	9.843963	9.845206	9.846443	9.847675	9.848900	9.850119	36
25	15	840220	841481	842735	843984	845227	846464	847695	848920	850140	35
26	30	840241	841501	842756	844005	845248	846485	847716	848941	850160	34
27	45	840262	841522	842777	844026	845268	846505	847736	848961	850180	33
28	0	9.840283	9.841543	9.842798	9.844046	9.845289	9.846526	9.847756	9.848981	9.850200	32
29	15	840304	841564	842819	844067	845310	846547	847777	849002	850221	31
30	30	840325	841585	842840	844088	845330	846567	847797	849022	850241	30
31	45	840346	841606	842860	844109	845351	846587	847818	849042	850261	29
32	0	9.840367	9.841627	9.842881	9.844129	9.845372	9.846608	9.847838	9.849063	9.850282	28
33	15	840388	841648	842902	844150	845392	846628	847859	849083	850302	27
34	30	840409	841669	842923	844171	845413	846649	847879	849104	850322	26
35	45	840430	841690	842944	844192	845434	846670	847900	849124	850342	25
36	0	9.840451	9.841711	9.842965	9.844212	9.845454	9.846690	9.847920	9.849144	9.850363	24
37	15	840472	841732	842986	844233	845475	846711	847941	849165	850383	23
38	30	840493	841753	843006	844254	845495	846731	847961	849185	850403	22
39	45	840515	841774	843027	844275	845516	846752	847981	849205	850423	21
40	0	9.840536	9.841795	9.843048	9.844295	9.845537	9.846772	9.848002	9.849226	9.850444	20
41	15	840557	841816	843069	844316	845557	846793	848022	849246	850464	19
42	30	840578	841837	843090	844337	845578	846813	848043	849266	850484	18
43	45	840599	841858	843111	844358	845599	846834	848063	849287	850504	17
44	0	9.840620	9.841879	9.843131	9.844378	9.845619	9.846854	9.848084	9.849307	9.850525	16
45	15	840641	841899	843152	844399	845640	846875	848104	849327	850545	15
46	30	840662	841920	843173	844420	845661	846896	848125	849348	850565	14
47	45	840683	841941	843194	844440	845681	846916	848145	849368	850585	13
48	0	9.840704	9.841962	9.843215	9.844461	9.845702	9.846937	9.848165	9.849388	9.850606	12
49	15	840725	841983	843236	844482	845722	846957	848186	849409	850626	11
50	30	840746	842004	843256	844503	845743	846978	848206	849429	850646	10
51	45	840767	842025	843277	844523	845764	846998	848227	849449	850666	9
52	0	9.840788	9.842046	9.843298	9.844544	9.845784	9.847019	9.848247	9.849470	9.850686	8
53	15	840809	842067	843319	844565	845805	847039	848268	849490	850707	7
54	30	840830	842088	843340	844586	845826	847060	848288	849510	850727	6
55	45	840851	842109	843360	844606	845846	847080	848308	849531	850747	5
56	0	9.840872	9.842130	9.843381	9.844627	9.845867	9.847101	9.848329	9.849551	9.850767	4
57	15	840893	842151	843402	844648	845887	847121	848349	849571	850788	3
58	30	840914	842171	843423	844668	845908	847142	848370	849592	850808	2
59	45	840935	842192	843444	844689	845929	847162	848390	849612	850828	1
60	0	9.840956	9.842213	9.843461	9.844710	9.845949	9.847183	9.848410	9.849632	9.850848	0
30 ^s	29 ^m	28 ^m	27 ^m	26 ^m	25 ^m	24 ^m	23 ^m	22 ^m	21 ^m	20 ^m	30 ^s

[illegible]

	50 ^m	51 ^m	52 ^m	53 ^m	54 ^m	55 ^m	56 ^m	57 ^m	58 ^m	59 ^m	
sec.	117 deg.					118 deg.					sec.
0	0	9.863843	9.864990	9.866131	9.867267	9.868397	9.869522	9.870641	9.871754	9.872862	9.873964
1	15	863862	865008	866150	867286	868416	869540	870659	871773	872880	873983
2	30	863881	865028	866169	867305	868435	869559	870678	871791	872899	874001
3	45	863900	865047	866188	867324	868454	869578	870697	871810	872917	874019
4	0	9.863919	9.865066	9.866207	9.867342	9.868472	9.869597	9.870715	9.871828	9.872936	9.874038
5	15	863938	865085	866226	867361	868491	869615	870734	871847	872954	874056
6	30	863958	865104	866245	867380	868510	869634	870752	871865	872973	874074
7	45	863977	865123	866264	867399	868529	869653	870771	871884	872991	874093
8	0	9.863996	9.865142	9.866283	9.867418	9.868547	9.869671	9.870790	9.871902	9.873009	9.874111
9	15	864015	865161	866302	867437	868566	869690	870808	871921	873028	874129
10	30	864034	865180	866321	867456	868585	869709	870827	871939	873046	874148
11	45	864053	865199	866339	867475	868604	869727	870845	871958	873065	874166
12	0	9.864073	9.865218	9.866359	9.867493	9.868623	9.869746	9.870864	9.871976	9.873083	9.874184
13	15	864092	865237	866378	867512	868641	869765	870882	871995	873101	874203
14	30	864111	865257	866397	867531	868660	869783	870901	872013	873120	874221
15	45	864130	865276	866416	867550	868679	869802	870920	872032	873138	874239
16	0	9.864149	9.865295	9.866435	9.867569	9.868698	9.869821	9.870938	9.872050	9.873157	9.874257
17	15	864168	865314	866454	867588	868716	869839	870957	872069	873175	874276
18	30	864187	865333	866473	867607	868735	869858	870975	872087	873193	874294
19	45	864206	865352	866492	867625	868754	869877	870994	872106	873212	874312
20	0	9.864226	9.865371	9.866510	9.867644	9.868773	9.869895	9.871013	9.872124	9.873230	9.874331
21	15	864245	865390	866529	867663	868792	869914	871031	872143	873249	9.874349
22	30	864264	865409	866548	867682	868810	869933	871050	872161	873267	874367
23	45	864283	865428	866567	867701	868829	869951	871068	872180	873285	874386
24	0	9.864302	9.865447	9.866586	9.867720	9.868848	9.869970	9.871087	9.872198	9.873304	9.874404
25	15	864321	865466	866605	867739	868866	869989	871105	872216	873322	874423
26	30	864340	865485	866624	867757	868885	870007	871124	872235	873340	874440
27	45	864359	865504	866643	867776	868904	870026	871142	872253	873359	874459
28	0	9.864379	9.865523	9.866662	9.867795	9.868923	9.870045	9.871161	9.872272	9.873377	9.874477
29	15	864398	865542	866681	867814	868941	870063	871180	872290	873396	874495
30	30	864417	865561	866700	867833	868960	870082	871198	872309	873414	874514
31	45	864436	865580	866719	867852	868979	870100	871217	872327	873432	874532
32	0	9.864455	9.865599	9.866738	9.867870	9.868998	9.870119	9.871235	9.872346	9.873451	9.874550
33	15	864474	865618	866756	867889	869016	870138	871254	872366	873469	874568
34	30	864493	865637	866776	867908	869035	870157	871272	872383	873487	874587
35	45	864512	865656	866794	867927	869054	870176	871291	872401	873506	874605
36	0	9.864532	9.865675	9.866813	9.867946	9.869073	9.870194	9.871310	9.872420	9.873524	9.874623
37	15	864551	865694	866832	867965	869091	870212	871328	872438	873543	874641
38	30	864570	865713	866851	867983	869110	870231	871347	872457	873561	874660
39	45	864589	865732	866870	868002	869129	870250	871365	872475	873579	874678
40	0	9.864608	9.865751	9.866889	9.868021	9.869148	9.870268	9.871384	9.872493	9.873598	9.874696
41	15	864627	865770	866908	868040	869166	870287	871402	872512	873616	874714
42	30	864646	865789	866927	868059	869185	870306	871421	872530	873634	874733
43	45	864665	865808	866946	868078	869204	870324	871439	872549	873653	874751
44	0	9.864684	9.865827	9.866965	9.868096	9.869222	9.870343	9.871458	9.872567	9.873671	9.874769
45	15	864703	865846	866984	868115	869241	870362	871476	872586	873689	874788
46	30	864723	865865	867002	868134	869260	870380	871495	872604	873708	874806
47	45	864742	865884	867021	868153	869278	870399	871513	872623	873726	874824
48	0	9.864761	9.865903	9.867040	9.868172	9.869297	9.870417	9.871532	9.872641	9.873744	9.874842
49	15	864780	865922	867059	868190	869316	870436	871550	872660	873763	874860
50	30	864799	865941	867078	868209	869335	870455	871569	872678	873781	874879
51	45	864818	865960	867097	868228	869354	870473	871588	872696	873799	874897
52	0	9.864837	9.865979	9.867116	9.868247	9.869372	9.870492	9.871606	9.872715	9.873818	9.874915
53	15	864856	865998	867135	868266	869391	870510	871624	872733	873836	874934
54	30	864875	866017	867154	868284	869410	870529	871643	872752	873854	874952
55	45	864894	866036	867172	868303	869428	870548	871662	872770	873873	874970
56	0	9.864913	9.866055	9.867191	9.868322	9.869447	9.870566	9.871680	9.872788	9.873891	9.874988
57	15	864932	866074	867210	868341	869466	870585	871699	872807	873909	875007
58	30	864952	866093	867229	868360	869484	870604	871717	872825	873928	875025
59	45	864971	866112	867248	868378	869503	870622	871736	872844	873946	875043
60	0	9.864990	9.866131	9.867267	9.868397	9.869522	9.870641	9.871754	9.872862	9.873964	9.875061
		9 ^m	8 ^m	7 ^m	6 ^m	5 ^m	4 ^m	3 ^m	2 ^m	1 ^m	0 ^m

		0 ^m				1 ^m				2 ^m				3 ^m				4 ^m				5 ^m				6 ^m				7 ^m				8 ^m				9 ^m													
		120 deg.																121 deg.																122 deg.																	
		0'				15'				30'				45'				0'				15'				30'				45'				0'				15'				30'				45'					
0	0	9.875061	9.876153	9.877238	9.878319	9.879394	9.880463	9.881527	9.882585	9.883639	9.884686	60	0	9.875061	9.876153	9.877238	9.878319	9.879394	9.880463	9.881527	9.882585	9.883639	9.884686	60	0	9.875061	9.876153	9.877238	9.878319	9.879394	9.880463	9.881527	9.882585	9.883639	9.884686	60	0	9.875061	9.876153	9.877238	9.878319	9.879394	9.880463	9.881527	9.882585	9.883639	9.884686	60			
15	0	875079	876171	877256	878337	879411	880481	881545	882603	883656	884704	59	15	875079	876171	877256	878337	879411	880481	881545	882603	883656	884704	59	15	875079	876171	877256	878337	879411	880481	881545	882603	883656	884704	59	15	875079	876171	877256	878337	879411	880481	881545	882603	883656	884704	59			
30	0	875098	876189	877274	878355	879429	880498	881562	882621	883674	884721	58	30	875098	876189	877274	878355	879429	880498	881562	882621	883674	884721	58	30	875098	876189	877274	878355	879429	880498	881562	882621	883674	884721	58	30	875098	876189	877274	878355	879429	880498	881562	882621	883674	884721	58			
345	0	875116	876207	877292	878373	879447	880516	881580	882633	883691	884738	57	345	875116	876207	877292	878373	879447	880516	881580	882633	883691	884738	57	345	875116	876207	877292	878373	879447	880516	881580	882633	883691	884738	57	345	875116	876207	877292	878373	879447	880516	881580	882633	883691	884738	57			
		1'				16'				31'				46'				1'				16'				31'				46'				1'				16'				31'				46'					
4	0	9.875134	9.876225	9.877311	9.878391	9.879465	9.880534	9.881598	9.882656	9.883709	9.884756	56	4	9.875134	9.876225	9.877311	9.878391	9.879465	9.880534	9.881598	9.882656	9.883709	9.884756	56	4	9.875134	9.876225	9.877311	9.878391	9.879465	9.880534	9.881598	9.882656	9.883709	9.884756	56	4	9.875134	9.876225	9.877311	9.878391	9.879465	9.880534	9.881598	9.882656	9.883709	9.884756	56			
515	0	875152	876243	877329	878408	879483	880552	881615	882673	883726	884773	55	515	875152	876243	877329	878408	879483	880552	881615	882673	883726	884773	55	515	875152	876243	877329	878408	879483	880552	881615	882673	883726	884773	55	515	875152	876243	877329	878408	879483	880552	881615	882673	883726	884773	55			
630	0	875171	876261	877347	878426	879501	880570	881633	882691	883744	884791	54	630	875171	876261	877347	878426	879501	880570	881633	882691	883744	884791	54	630	875171	876261	877347	878426	879501	880570	881633	882691	883744	884791	54	630	875171	876261	877347	878426	879501	880570	881633	882691	883744	884791	54			
715	0	875189	876280	877365	878444	879519	880587	881651	882709	883761	884808	53	715	875189	876280	877365	878444	879519	880587	881651	882709	883761	884808	53	715	875189	876280	877365	878444	879519	880587	881651	882709	883761	884808	53	715	875189	876280	877365	878444	879519	880587	881651	882709	883761	884808	53			
		2'				17'				32'				47'				2'				17'				32'				47'				2'				17'				32'				47'					
8	0	9.875207	9.876298	9.877383	9.878462	9.879536	9.880605	9.881668	9.882726	9.883779	9.884826	52	8	9.875207	9.876298	9.877383	9.878462	9.879536	9.880605	9.881668	9.882726	9.883779	9.884826	52	8	9.875207	9.876298	9.877383	9.878462	9.879536	9.880605	9.881668	9.882726	9.883779	9.884826	52	8	9.875207	9.876298	9.877383	9.878462	9.879536	9.880605	9.881668	9.882726	9.883779	9.884826	52			
915	0	875225	876316	877401	878480	879554	880623	881686	882744	883796	884843	51	915	875225	876316	877401	878480	879554	880623	881686	882744	883796	884843	51	915	875225	876316	877401	878480	879554	880623	881686	882744	883796	884843	51	915	875225	876316	877401	878480	879554	880623	881686	882744	883796	884843	51			
1030	0	875244	876334	877419	878498	879572	880641	881704	882761	883814	884860	50	1030	875244	876334	877419	878498	879572	880641	881704	882761	883814	884860	50	1030	875244	876334	877419	878498	879572	880641	881704	882761	883814	884860	50	1030	875244	876334	877419	878498	879572	880641	881704	882761	883814	884860	50			
1145	0	875262	876352	877437	878516	879590	880658	881721	882779	883831	884878	49	1145	875262	876352	877437	878516	879590	880658	881721	882779	883831	884878	49	1145	875262	876352	877437	878516	879590	880658	881721	882779	883831	884878	49	1145	875262	876352	877437	878516	879590	880658	881721	882779	883831	884878	49			
		3'				18'				33'				48'				3'				18'				33'				48'				3'				18'				33'				48'					
12	0	9.875280	9.876370	9.877455	9.878534	9.879608	9.880676	9.881739	9.882796	9.883848	9.884895	48	12	9.875280	9.876370	9.877455	9.878534	9.879608	9.880676	9.881739	9.882796	9.883848	9.884895	48	12	9.875280	9.876370	9.877455	9.878534	9.879608	9.880676	9.881739	9.882796	9.883848	9.884895	48	12	9.875280	9.876370	9.877455	9.878534	9.879608	9.880676	9.881739	9.882796	9.883848	9.884895	48			
1315	0	875298	876388	877473	878551	879626	880694	881757	882814	883866	884912	47	1315	875298	876388	877473	878551	879626	880694	881757	882814	883866	884912	47	1315	875298	876388	877473	878551	879626	880694	881757	882814	883866	884912	47	1315	875298	876388	877473	878551	879626	880694	881757	882814	883866	884912	47			
1430	0	875316	876406	877491	878570	879644	880711	881774	882832	883883	884930	46	1430	875316	876406	877491	878570	879644	880711	881774	882832	883883	884930	46	1430	875316	876406	877491	878570	879644	880711	881774	882832	883883	884930	46	1430	875316	876406	877491	878570	879644	880711	881774	882832	883883	884930	46			
1545	0	875335	876425	877509	878588	879661	880729	881792	882849	883901	884947	45	1545	875335	876425	877509	878588	879661	880729	881792	882849	883901	884947	45	1545	875335	876425	877509	878588	879661	880729	881792	882849	883901	884947	45	1545	875335	876425	877509	878588	879661	880729	881792	882849	883901	884947	45			
		4'				19'				34'				49'				4'				19'				34'				49'				4'				19'				34'				49'					
16	0	9.875353	9.876443	9.877527	9.878606	9.879679	9.880747	9.881810	9.882867	9.883918	9.884965	44	16	9.875353	9.876443	9.877527	9.878606	9.879679	9.880747	9.881810	9.882867	9.883918	9.884965	44	16	9.875353	9.876443	9.877527	9.878606	9.879679	9.880747	9.881810	9.882867	9.883918	9.884965	44	16	9.875353	9.876443	9.877527	9.878606	9.879679	9.880747	9.881810	9.882867	9.883918	9.884965	44			
1715	0	875371	876461	877545	878624	879697	880765	881827	882885	883936	884982	43	1715	875371	876461	877545	878624	879697	880765	881827	882885	883936	884982	43	1715	875371	876461	877545	878624	879697	880765	881827	882885	883936	884982	43	1715	875371	876461	877545	878624	879697	880765	881827	882885	883936	884982	43			
1830	0	875389	876479	877563	878642	879715	880783	881845	882902	883953	884999	42	1830	875389	876479	877563	878642	879715	880783	881845	882902	883953	884999	42	1830	875389	876479	877563	878642	879715	880783	881845	882902	883953	884999	42	1830	875389	876479	877563	878642	879715	880783	881845	882902	883953	884999	42			
1945	0	875407	876497	877581	878660	879733	880800	881863	882919	883971	885017	41	1945	875407	876497	877581	878660	879733	880800	881863	882919	883971	885017	41	1945	875407	876497	877581	878660	879733	880800	881863	882919	883971	885017	41															

	10 ^m	11 ^m	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m			
	122 deg.			123 deg.			124 deg.						
SEC.	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	SEC.
0 0	9.885729	9.886765	9.887797	9.888823	9.889844	9.890860	9.891870	9.892875	9.893874	9.894869	60		0 0
1 15	885746	886783	887814	888840	889861	890875	891887	892891	893891	894889	59		1 15
2 30	885763	886800	887831	888857	889878	890893	891903	892908	893908	894905	58		2 30
3 45	885780	886817	887848	888874	889895	890910	891920	892925	893924	894918	57		3 45
4 0	9.885798	9.886834	9.887866	9.888891	9.889912	9.890927	9.891937	9.892941	9.893941	9.894935	56		4 0
5 15	885815	886852	887883	888908	889929	890944	891954	892958	893957	894951	55		5 15
6 30	885832	886869	887900	888926	889946	890961	891971	892975	893974	894968	54		6 30
7 45	885850	886886	887917	888943	889963	890978	891987	892992	893991	894984	53		7 45
8 0	9.885867	9.886903	9.887934	9.888960	9.889980	9.890995	9.892004	9.893008	9.894007	9.895001	52		8 0
9 15	885884	886920	887951	888977	889997	891011	892021	893025	894024	895017	51		9 15
10 30	885902	886938	887968	888994	890014	891028	892038	893042	894040	895034	50		10 30
11 45	885919	886955	887985	889011	890031	891045	892054	893058	894057	895050	49		11 45
12 0	9.885936	9.886972	9.888003	9.889028	9.890048	9.891062	9.892071	9.893075	9.894074	9.895067	48		12 0
13 15	885954	886999	888020	889045	890065	891079	892088	893092	894090	895083	47		13 15
14 30	885971	887007	888037	889062	890082	891096	892105	893108	894107	895100	46		14 30
15 45	885988	887024	888054	889079	890098	891113	892121	893125	894123	895116	45		15 45
16 0	9.886006	9.887041	9.888071	9.889096	9.890115	9.891130	9.892138	9.893142	9.894140	9.895133	44		16 0
17 15	886023	887058	888088	889113	890132	891146	892155	893158	894157	895149	43		17 15
18 30	886040	887075	888105	889130	890149	891163	892172	893175	894173	895166	42		18 30
19 45	886058	887093	888122	889147	890166	891180	892189	893192	894190	895182	41		19 45
20 0	9.886075	9.887110	9.888140	9.889164	9.890183	9.891197	9.892205	9.893209	9.894206	9.895199	40		20 0
21 15	886092	887127	888157	889181	890200	891214	892222	893225	894223	895215	39		21 15
22 30	886109	887144	888174	889198	890217	891231	892239	893242	894240	895232	38		22 30
23 45	886127	887161	888191	889215	890234	891247	892256	893259	894256	895248	37		23 45
24 0	9.886144	9.887179	9.888208	9.889232	9.890251	9.891264	9.892272	9.893275	9.894273	9.895265	36		24 0
25 15	886161	887196	888225	889249	890268	891281	892289	893292	894289	895281	35		25 15
26 30	886179	887213	888242	889266	890285	891298	892306	893309	894306	895298	34		26 30
27 45	886196	887230	888259	889283	890302	891315	892323	893325	894322	895314	33		27 45
28 0	9.886213	9.887248	9.888277	9.889300	9.890319	9.891332	9.892339	9.893342	9.894339	9.895331	32		28 0
29 15	886230	887265	888294	889317	890336	891348	892356	893359	894356	895347	31		29 15
30 30	886248	887281	888311	889334	890353	891365	892373	893375	894372	895364	30		30 30
31 45	886265	887299	888328	889351	890369	891382	892390	893392	894389	895380	29		31 45
32 0	9.886282	9.887316	9.888345	9.889368	9.890386	9.891399	9.892406	9.893409	9.894405	9.895397	28		32 0
33 15	886299	887333	888362	889385	890403	891416	892423	893425	894422	895414	27		33 15
34 30	886317	887351	888379	889402	890420	891433	892440	893442	894439	895430	26		34 30
35 45	886334	887368	888396	889419	890437	891449	892457	893458	894455	895446	25		35 45
36 0	9.886351	9.887385	9.888413	9.889436	9.890454	9.891466	9.892473	9.893475	9.894472	9.895463	24		36 0
37 15	886369	887404	888430	889453	890471	891483	892490	893492	894488	895479	23		37 15
38 30	886386	887419	888448	889470	890488	891500	892507	893508	894505	895496	22		38 30
39 45	886403	887437	888465	889487	890505	891517	892524	893525	894521	895512	21		39 45
40 0	9.886420	9.887454	9.888482	9.889504	9.890522	9.891534	9.892540	9.893542	9.894538	9.895529	20		40 0
41 15	886438	887471	888499	889521	890539	891550	892557	893559	894554	895545	19		41 15
42 30	886455	887488	888516	889538	890556	891567	892574	893575	894571	895562	18		42 30
43 45	886472	887505	888533	889555	890572	891584	892591	893592	894587	895578	17		43 45
44 0	9.886489	9.887522	9.888550	9.889572	9.890589	9.891601	9.892607	9.893608	9.894604	9.895595	16		44 0
45 15	886507	887540	888567	889589	890606	891618	892624	893625	894621	895611	15		45 15
46 30	886524	887557	888584	889606	890623	891635	892641	893642	894637	895628	14		46 30
47 45	886541	887574	888601	889623	890640	891651	892657	893658	894654	895644	13		47 45
48 0	9.886558	9.887591	9.888618	9.889640	9.890657	9.891668	9.892674	9.893675	9.894670	9.895660	12		48 0
49 15	886576	887608	888635	889657	890674	891685	892691	893691	894687	895677	11		49 15
50 30	886593	887625	888653	889674	890691	891702	892708	893708	894703	895693	10		50 30
51 45	886610	887643	888670	889691	890708	891719	892724	893725	894720	895710	9		51 45
52 0	9.886628	9.887660	9.888687	9.889708	9.890725	9.891735	9.892741	9.893741	9.894736	9.895726	8		52 0
53 15	886645	887677	888704	889725	890741	891752	892758	893758	894753	895743	7		53 15
54 30	886662	887694	888721	889742	890758	891769	892775	893775	894770	895759	6		54 30
55 45	886679	887711	888738	889759	890775	891786	892791	893791	894786	895776	5		55 45
56 0	9.886696	9.887728	9.888755	9.889776	9.890792	9.891803	9.892808	9.893808	9.894803	9.895792	4		56 0
57 15	886714	887746	888772	889793	890808	891819	892825	893824	894819	895808	3		57 15
58 30	886731	887763	888789	889810	890826	891836	892841	893841	894836	895825	2		58 30
59 45	886748	887780	888806	889827	890843	891853	892858	893858	894852	895841	1		59 45
60 0	9.886765	9.887797	9.888823	9.889844	9.890860	9.891870	9.892875	9.893874	9.894869	9.895858	0		60 0
SEC.	49 ^m	48 ^m	47 ^m	46 ^m	45 ^m	44 ^m	43 ^m	42 ^m	41 ^m	40 ^m			

		20 ^m	21 ^m	22 ^m	23 ^m	24 ^m	25 ^m	26 ^m	27 ^m	28 ^m	29 ^m		
		125 deg.				126 deg.				127 deg.			
SEC.		0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	SEC.	
0	0	9.895855	9.896842	9.897820	9.898794	9.899762	9.900725	9.901682	9.902635	9.903582	9.904540	60	0
1	15	895874	896858	897836	898810	899778	900741	901698	902651	903598	904546	59	15
2	30	895891	896874	897853	898826	899794	900757	901714	902667	903614	904556	58	30
3	45	895907	896891	897869	898842	899810	900773	901730	902682	903630	904572	57	45
4	0	9.895924	9.896907	9.897885	9.898858	9.899826	9.900789	9.901746	9.902698	9.903645	9.904587	56	0
5	15	895940	896923	897901	898874	899842	900805	901762	902714	903661	904603	55	15
6	30	895956	896940	897918	898891	899858	900821	901778	902730	903677	904619	54	30
7	45	895973	896956	897934	898907	899874	900837	901794	902746	903693	904635	53	45
8	0	9.895989	9.896972	9.897950	9.898923	9.899890	9.900853	9.901810	9.902762	9.903708	9.904650	52	0
9	15	896006	896989	897967	898939	899906	900869	901826	902778	903724	904665	51	15
10	30	896022	897005	897983	898955	899923	900885	901842	902793	903740	904681	50	30
11	45	896039	897021	897999	898971	899939	900901	901857	902809	903755	904697	49	45
12	0	9.896055	9.897038	9.898015	9.898988	9.899955	9.900917	9.901873	9.902825	9.903771	9.904712	48	0
13	15	896071	897054	898032	899004	899971	900933	901889	902841	903787	904728	47	15
14	30	896088	897070	898048	899020	899987	900949	901905	902857	903803	904744	46	30
15	45	896104	897087	898064	899036	900003	900965	901921	902872	903818	904760	45	45
16	0	9.896121	9.897103	9.898080	9.899052	9.900019	9.900981	9.901937	9.902888	9.903834	9.904775	44	0
17	15	896137	897119	898097	899068	900035	900997	901953	902904	903850	904791	43	15
18	30	896154	897136	898113	899085	900051	901013	901969	902920	903866	904807	42	30
19	45	896170	897152	898129	899101	900067	901028	901985	902935	903881	904822	41	45
20	0	9.896186	9.897168	9.898145	9.899117	9.900083	9.901045	9.902001	9.902951	9.903897	9.904838	40	0
21	15	896203	897185	898161	899133	900099	901060	902016	902967	903913	904853	39	15
22	30	896219	897201	898178	899149	900115	901076	902032	902983	903928	904869	38	30
23	45	896236	897217	898194	899165	900131	901092	902048	902999	903944	904884	37	45
24	0	9.896252	9.897234	9.898210	9.899182	9.900148	9.901108	9.902064	9.903015	9.903960	9.904900	36	0
25	15	896268	897250	898226	899198	900164	901124	902080	903030	903976	904916	35	15
26	30	896285	897266	898243	899214	900180	901140	902096	903046	903991	904931	34	30
27	45	896301	897283	898259	899230	900196	901156	902112	903062	904007	904947	33	45
28	0	9.896318	9.897299	9.898275	9.899246	9.900212	9.901172	9.902128	9.903078	9.904023	9.904963	32	0
29	15	896334	897316	898291	899262	900228	901188	902144	903094	904038	904978	31	15
30	30	896350	897332	898308	899278	900244	901204	902159	903109	904054	904994	30	30
31	45	896367	897348	898324	899294	900260	901220	902175	903125	904070	905009	29	45
32	0	9.896383	9.897364	9.898340	9.899311	9.900276	9.901236	9.902191	9.903141	9.904086	9.905025	28	0
33	15	896400	897380	898356	899327	900292	901252	902207	903157	904101	905041	27	15
34	30	896416	897397	898373	899343	900308	901268	902223	903172	904117	905056	26	30
35	45	896432	897413	898389	899359	900324	901284	902239	903188	904133	905072	25	45
36	0	9.896449	9.897429	9.898405	9.899375	9.900340	9.901300	9.902255	9.903204	9.904148	9.905087	24	0
37	15	896465	897446	898421	899391	900356	901316	902270	903220	904164	905103	23	15
38	30	896482	897462	898437	899407	900372	901332	902286	903236	904180	905119	22	30
39	45	896498	897478	898453	899423	900388	901348	902302	903251	904195	905134	21	45
40	0	9.896514	9.897495	9.898470	9.899440	9.900404	9.901364	9.902318	9.903267	9.904211	9.905150	20	0
41	15	896531	897511	898486	899456	900420	901380	902334	903283	904227	905165	19	15
42	30	896547	897527	898501	899472	900436	901396	902350	903299	904242	905181	18	30
43	45	896563	897543	898518	899488	900452	901412	902366	903314	904258	905197	17	45
44	0	9.896580	9.897560	9.898535	9.899504	9.900468	9.901428	9.902382	9.903333	9.904274	9.905212	16	0
45	15	896596	897576	898551	899520	900484	901443	902398	903346	904289	905228	15	15
46	30	896613	897592	898567	899536	900500	901459	902413	903362	904305	905243	14	30
47	45	896629	897609	898583	899552	900516	901475	902429	903378	904321	905259	13	45
48	0	9.896645	9.897625	9.898599	9.899569	9.900532	9.901491	9.902445	9.903393	9.904337	9.905275	12	0
49	15	896662	897641	898615	899585	900548	901507	902461	903409	904352	905290	11	15
50	30	896678	897658	898632	899601	900565	901523	902477	903425	904368	905306	10	30
51	45	896694	897674	898648	899617	900581	901539	902492	903441	904384	905321	9	45
52	0	9.896711	9.897690	9.898664	9.899633	9.900597	9.901555	9.902508	9.903456	9.904399	9.905337	8	0
53	15	896727	897706	898680	899649	900613	901571	902524	903472	904415	905353	7	15
54	30	896744	897723	898697	899665	900629	901587	902540	903488	904431	905368	6	30
55	45	896760	897739	898713	899681	900645	901603	902556	903504	904446	905384	5	45
56	0	9.896776	9.897755	9.898729	9.899697	9.900661	9.901619	9.902572	9.903519	9.904462	9.905399	4	0
57	15	896793	897771	898745	899713	900677	901635	902587	903535	904478	905414	3	15
58	30	896809	897788	898761	899730	900693	901651	902603	903551	904493	905430	2	30
59	45	896825	897804	898777	899746	900709	901666	902619	903567	904509	905446	1	45
60	0	9.896842	9.897820	9.898794	9.899762	9.900725	9.901682	9.902635	9.903582	9.904525	9.905462	0	0
SEC.		39 ^m	38 ^m	37 ^m	36 ^m	35 ^m	34 ^m	33 ^m	32 ^m	31 ^m	30 ^m	SEC.	

	30 ^m	31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	36 ^m	37 ^m	38 ^m	39 ^m	
	127 deg.		128 deg.				129 deg.				
sec.	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	sec.
0	9.905462	9.906394	9.907320	9.908242	9.909159	9.910070	9.910976	9.911878	9.912774	9.913665	60
1	15 905477	906409	907336	908257	909174	910085	910992	911893	912789	913680	59
2	30 905493	906425	907351	908273	909189	910100	911007	911908	912804	913695	58
3	45 905508	906440	907367	908288	909204	910116	911022	911923	912819	913710	57
4	0 9.905524	9.906456	9.907382	9.908303	9.909220	9.910131	9.911037	9.911938	9.912834	9.913725	56
5	15 905539	906471	907397	908319	909235	910146	911052	911953	912849	913739	55
6	30 905555	906486	907413	908334	909250	910161	911067	911968	912863	913754	54
7	45 905571	906502	907428	908349	909265	910176	911082	911983	912878	913769	53
8	0 9.905586	9.906517	9.907444	9.908365	9.909280	9.910191	9.911097	9.911998	9.912893	9.913784	52
9	15 905602	906533	907459	908380	909296	910206	911112	912013	912908	913798	51
10	30 905617	906548	907474	908395	909311	910222	911127	912028	912923	913813	50
11	45 905633	906564	907490	908410	909326	910237	911142	912043	912938	913828	49
12	0 9.905648	9.906579	9.907505	9.908426	9.909341	9.910252	9.911157	9.912057	9.912953	9.913843	48
13	15 905664	906595	907520	908441	909357	910267	911172	912072	912968	913858	47
14	30 905680	906610	907536	908456	909372	910282	911187	912087	912982	913872	46
15	45 905695	906626	907551	908472	909387	910297	911202	912102	912997	913887	45
16	0 9.905711	9.906641	9.907567	9.908487	9.909402	9.910312	9.911217	9.912117	9.913012	9.913902	44
17	15 905726	906657	907582	908502	909417	910327	911232	912132	913027	913917	43
18	30 905742	906672	907597	908518	909433	910343	911247	912147	913042	913932	42
19	45 905757	906688	907613	908533	909448	910358	911262	912162	913057	913946	41
20	0 9.905773	9.906703	9.907628	9.908548	9.909463	9.910373	9.911277	9.912177	9.913072	9.913961	40
21	15 905788	906719	907644	908563	909478	910388	911293	912192	913087	913976	39
22	30 905804	906734	907659	908579	909493	910403	911308	912207	913101	913991	38
23	45 905819	906749	907674	908594	909509	910418	911323	912222	913116	914006	37
24	0 9.905835	9.906765	9.907690	9.908609	9.909524	9.910433	9.911338	9.912237	9.913131	9.914020	36
25	15 905851	906780	907705	908625	909539	910448	911353	912252	913146	914035	35
26	30 905866	906796	907720	908640	909554	910463	911368	912267	913161	914050	34
27	45 905882	906811	907736	908655	909569	910479	911383	912282	913176	914065	33
28	0 9.905897	9.906827	9.907751	9.908670	9.909585	9.910494	9.911398	9.912297	9.913191	9.914079	32
29	15 905913	906842	907766	908686	909600	910509	911413	912312	913206	914094	31
30	30 905928	906858	907782	908701	909615	910524	911428	912327	913221	914109	30
31	45 905944	906873	907797	908716	909630	910539	911443	912342	913235	914124	29
32	0 9.905959	9.906889	9.907813	9.908732	9.909645	9.910554	9.911458	9.912356	9.913250	9.914139	28
33	15 905975	906904	907828	908747	909661	910569	911473	912371	913265	914153	27
34	30 905990	906919	907843	908762	909676	910584	911488	912386	913280	914168	26
35	45 906006	906933	907859	908777	909691	910599	911503	912401	913295	914183	25
36	0 9.906021	9.906950	9.907874	9.908793	9.909706	9.910615	9.911518	9.912416	9.913309	9.914198	24
37	15 906037	906966	907889	908808	909721	910630	911533	912431	913324	914212	23
38	30 906052	906981	907905	908823	909736	910645	911548	912446	913339	914227	22
39	45 906068	906997	907920	908838	909752	910660	911563	912461	913354	914242	21
40	0 9.906084	9.907012	9.907935	9.908854	9.909767	9.910675	9.911578	9.912476	9.913369	9.914257	20
41	15 906099	907027	907951	908869	909782	910690	911593	912491	913384	914271	19
42	30 906115	907043	907966	908884	909797	910705	911608	912506	913398	914286	18
43	45 906130	907058	907981	908899	909812	910720	911623	912521	913413	914301	17
44	0 9.906146	9.907074	9.907997	9.908915	9.909828	9.910735	9.911638	9.912536	9.913428	9.914316	16
45	15 906161	907089	908012	908930	909843	910750	911653	912550	913443	914330	15
46	30 906177	907103	908027	908945	909858	910765	911668	912565	913458	914345	14
47	45 906192	907120	908043	908960	909873	910781	911683	912580	913473	914360	13
48	0 9.906208	9.907135	9.908058	9.908976	9.909888	9.910796	9.911698	9.912595	9.913487	9.914375	12
49	15 906223	907151	908073	908991	909903	910811	911713	912610	913502	914389	11
50	30 906239	907166	908089	909006	909919	910826	911728	912625	913517	914404	10
51	45 906254	907182	908104	909021	909934	910841	911743	912640	913532	914419	9
52	0 9.906270	9.907197	9.908119	9.909037	9.909949	9.910856	9.911758	9.912655	9.913547	9.914434	8
53	15 906285	907212	908135	909052	909964	910871	911773	912670	913562	914448	7
54	30 906301	907228	908150	909067	909979	910886	911788	912685	913576	914463	6
55	45 906316	907243	908165	909082	909994	910901	911803	912700	913591	914478	5
56	0 9.906332	9.907259	9.908181	9.909098	9.910009	9.910916	9.911818	9.912714	9.913606	9.914493	4
57	15 906347	907274	908196	909113	910025	910931	911833	912729	913621	914507	3
58	30 906363	907290	908211	909128	910040	910946	911848	912744	913636	914522	2
59	45 906378	907305	908227	909143	910055	910961	911866	912759	913650	914537	1
60	0 9.906394	9.907320	9.908242	9.909159	9.910070	9.910976	9.911878	9.912774	9.913665	9.914551	0
sec.	29 ^m	28 ^m	27 ^m	26 ^m	25 ^m	24 ^m	23 ^m	22 ^m	21 ^m	20 ^m	sec.

		40 ^m				41 ^m				42 ^m				43 ^m				44 ^m				45 ^m				46 ^m				47 ^m				48 ^m				49 ^m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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0'		15'				30'				45'				0'				15'				30'				45'				0'				15'				30'				45'				0'		15'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
0	0	9.91451	9.91543	9.91639	9.91780	9.91804	9.91897	9.91973	9.92061	9.92146	9.92230	9.92302	9.92366	9.92430	9.92494	9.92558	9.92622	9.92686	9.92750	9.92814	9.92878	9.92942	9.93006	9.93070	9.93134	9.93198	9.93262	9.93326	9.93390	9.93454	9.93518	9.93582	9.93646	9.93710	9.93774	9.93838	9.93902	9.93966	9.94030	9.94094	9.94158	9.94222	9.94286	9.94350	9.94414	9.94478	9.94542	9.94606	9.94670	9.94734	9.94798	9.94862	9.94926	9.94990	9.95054	9.95118	9.95182	9.95246	9.95310	9.95374	9.95438	9.95502	9.95566	9.95630	9.95694	9.95758	9.95822	9.95886	9.95950	9.96014	9.96078	9.96142	9.96206	9.96270	9.96334	9.96398	9.96462	9.96526	9.96590	9.96654	9.96718	9.96782	9.96846	9.96910	9.96974	9.97038	9.97102	9.97166	9.97230	9.97294	9.97358	9.97422	9.97486	9.97550	9.97614	9.97678	9.97742	9.97806	9.97870	9.97934	9.97998	9.98062	9.98126	9.98190	9.98254	9.98318	9.98382	9.98446	9.98510	9.98574	9.98638	9.98702	9.98766	9.98830	9.98894	9.98958	9.99022	9.99086	9.99150	9.99214	9.99278	9.99342	9.99406	9.99470	9.99534	9.99598	9.99662	9.99726	9.99790	9.99854	9.99918	9.99982	10.00046	10.00110	10.00174	10.00238	10.00302	10.00366	10.00430	10.00494	10.00558	10.00622	10.00686	10.00750	10.00814	10.00878	10.00942	10.01006	10.01070	10.01134	10.01198	10.01262	10.01326	10.01390	10.01454	10.01518	10.01582	10.01646	10.01710	10.01774	10.01838	10.01902	10.01966	10.02030	10.02094	10.02158	10.02222	10.02286	10.02350	10.02414	10.02478	10.02542	10.02606	10.02670	10.02734	10.02798	10.02862	10.02926	10.02990	10.03054	10.03118	10.03182	10.03246	10.03310	10.03374	10.03438	10.03502	10.03566	10.03630	10.03694	10.03758	10.03822	10.03886	10.03950	10.04014	10.04078	10.04142	10.04206	10.04270	10.04334	10.04398	10.04462	10.04526	10.04590	10.04654	10.04718	10.04782	10.04846	10.04910	10.04974	10.05038	10.05102	10.05166	10.05230	10.05294	10.05358	10.05422	10.05486	10.05550	10.05614	10.05678	10.05742	10.05806	10.05870	10.05934	10.05998	10.06062	10.06126	10.06190	10.06254	10.06318	10.06382	10.06446	10.06510	10.06574	10.06638	10.06702	10.06766	10.06830	10.06894	10.06958	10.07022	10.07086	10.07150	10.07214	10.07278	10.07342	10.07406	10.07470	10.07534	10.07598	10.07662	10.07726	10.07790	10.07854	10.07918	10.07982	10.08046	10.08110	10.08174	10.08238	10.08302	10.08366	10.08430	10.08494	10.08558	10.08622	10.08686	10.08750	10.08814	10.08878	10.08942	10.09006	10.09070	10.09134	10.09198	10.09262	10.09326	10.09390	10.09454	10.09518	10.09582	10.09646	10.09710	10.09774	10.09838	10.09902	10.09966	10.10030	10.10094	10.10158	10.10222	10.10286	10.10350	10.10414	10.10478	10.10542	10.10606	10.10670	10.10734	10.10798	10.10862	10.10926	10.10990	10.11054	10.11118	10.11182	10.11246	10.11310	10.11374	10.11438	10.11502	10.11566	10.11630	10.11694	10.11758	10.11822	10.11886	10.11950	10.12014	10.12078	10.12142	10.12206	10.12270	10.12334	10.12398	10.12462	10.12526	10.12590	10.12654	10.12718	10.12782	10.12846	10.12910	10.12974	10.13038	10.13102	10.13166	10.13230	10.13294	10.13358	10.13422	10.13486	10.13550	10.13614	10.13678	10.13742	10.13806	10.13870	10.13934	10.13998	10.14062	10.14126	10.14190	10.14254	10.14318	10.14382	10.14446	10.14510	10.14574	10.14638	10.14702	10.14766	10.14830	10.14894	10.14958	10.15022	10.15086	10.15150	10.15214	10.15278	10.15342	10.15406	10.15470	10.15534	10.15598	10.15662	10.15726	10.15790	10.15854	10.15918	10.15982	10.16046	10.16110	10.16174	10.16238	10.16302	10.16366	10.16430	10.16494	10.16558	10.16622	10.16686	10.16750	10.16814	10.16878	10.16942	10.17006	10.17070	10.17134	10.17198	10.17262	10.17326	10.17390	10.17454	10.17518	10.17582	10.17646	10.17710	10.17774	10.17838	10.17902	10.17966	10.18030	10.18094	10.18158	10.18222	10.18286	10.18350	10.18414	10.18478	10.18542	10.18606	10.18670	10.18734	10.18798	10.18862	10.18926	10.18990	10.19054	10.19118	10.19182	10.19246	10.19310	10.19374	10.19438	10.19502	10.19566	10.19630	10.19694	10.19758	10.19822	10.19886	10.19950	10.20014	10.20078	10.20142	10.20206	10.20270	10.20334	10.20398	10.20462	10.20526	10.20590	10.20654	10.20718	10.20782	10.20846	10.20910	10.20974	10.21038	10.21102	10.21166	10.21230	10.21294	10.21358	10.21422	10.21486	10.21550	10.21614	10.21678	10.21742	10.21806	10.21870	10.21934	10.21998	10.22062	10.22126	10.22190	10.22254	10.22318	10.22382	10.22446	10.22510	10.22574	10.22638	10.22702	10.22766	10.22830	10.22894	10.22958	10.23022	10.23086	10.23150	10.23214	10.23278	10.23342	10.23406	10.23470	10.23534	10.23598	10.23662	10.23726	10.23790	10.23854	10.23918	10.23982	10.24046	10.24110	10.24174	10.24238	10.24302	10.24366	10.24430	10.24494	10.24558	10.24622	10.24686	10.24750	10.24814	10.24878	10.24942	10.25006	10.25070	10.25134	10.25198	10.25262	10.25326	10.25390	10.25454	10.25518	10.25582	10.25646	10.25710	10.25774	10.25838	10.25902	10.25966	10.26030	10.26094	10.26158	10.26222	10.26286	10.26350	10.26414	10.26478	10.26542	10.26606	10.26670	10.26734	10.26798	10.26862	10.26926	10.26990	10.27054	10.27118	10.27182	10.27246	10.27310	10.27374	10.27438	10.27502	10.27566	10.27630	10.27694	10.27758	10.27822	10.27886	10.27950	10.28014	10.28078	10.28142	10.28206	10.28270	10.28334	10.28398	10.28462	10.28526	10.28590	10.28654	10.28718	10.28782	10.28846	10.28910	10.28974	10.29038	10.29102	10.29166	10.29230	10.29294	10.29358	10.29422	10.29486	10.29550	10.29614	10.29678	10.29742	10.29806	10.29870	10.29934	10.29998	10.30062	10.30126	10.30190	10.30254	10.30318	10.30382	10.30446	10.30510	10.30574	10.30638	10.30702	10.30766	10.30830	10.30894	10.30958	10.31022	10.31086	10.31150	10.31214	10.31278	10.31342	10.31406	10.31470	10.31534	10.31598	10.31662	10.31726	10.31790	10.31854	10.31918	10.31982	10.32046	10.32110	10.32174	10.32238	10.32302	10.32366	10.32430	10.32494	10.32558	10.32622	10.32686	10.32750	10.32814	10.32878	10.32942	10.33006	10.33070	10.33134	10.33198	10.33262	10.33326	10.33390	10.33454	10.33518	10.33582	10.33646	10.33710	10.33774	10.33838	10.33902	10.33966	10.34030	10.34094	10.34158	10.34222	10.34286	10.34350	10.34414	10.34478	10.34542	10.34606	10.34670	10.34734	10.34798	10.34862	10.34926	10.34990	10.35054	10.35118	10.35182	10.35246	10.35310	10.35374	10.35438	10.35502	10.35566	10.35630	10.35694	10.35758	10.35822	10.35886	10.35950	10.36014	10.36078	10.36142	10.36206	10.36270	10.36334	10.36398	10.36462	10.36526	10.36590	10.36654	10.36718	10.36782	10.36846	10.36910	10.36974	10.37038	10.37102	10.37166	10.37230	10.37294	10.37358	10.37422	10.37486	10.37550	10.37614	10.37678	10.37742	10.37806	10.37870	10.37934	10.37998	10.38062	10.38126	10.38190	10.38254	10.38318	10.38382	10.38446	10.38510	10.38574	10.38638	10.38702	10.38766	10.38830	10.38894	10.38958	10.39022	10.39086	10.39150	10.39214	10.39278	10.39342	10.39406	10.39470	10.39534	10.39598	10.39662	10.39726	10.39790	10.39854	10.39918	10.39982	10.40046	10.40110	10.40174	10.40238	10.40302	10.40366	10.40430	10.40494	10.40558	10.40622	10.40686	10.40750	10.40814	10.40878	10.40942	10.41006	10.41070	10.41134	10.41198	10.41262	10.41326	10.41390	10.41454	10.41518	10.41582	10.41646	10.41710	10.41774	10.41838	10.41902	10.41966	10.42030	10.42094	10.42158	10.42222	10.42286	10.42350	10.42414	10.42478	10.42542	10.42606	10.42670	10.42734	10.42798	10.42862	10.42926	10.42990	10.43054	10.43118	10.43182	10.43246	10.43310	10.43374	10.43438	10.43502	10.43566	10.43630	10.43694	10.43758	10.43822	10.43886	10.43950	10.44014	10.44078	10.44142	10.44206	10.44270	10.44334	10.44398	10.44462	10.44526	10.44590	10.44654	10.44718	10.44782	10.44846	10.44910	10.44974	10.45038	10.45102	10.45166	10.45230	10.45294	10.45358	10.45422	10.45486	10.45550	10.45614	10.45678	10.45742	10.45806	10.45870	10.45934	10.45998	10.46062	10.46126	10.46190	10.46252

SEC.	50 ^m		51 ^m		52 ^m		53 ^m		54 ^m		55 ^m		56 ^m		57 ^m		58 ^m		59 ^m		SEC.
	132 deg.				133 deg.				134 deg.												
	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	30'	45'	0'	15'	
0	9.923135	9.923969	9.924796	9.925617	9.926434	9.927245	9.928052	9.928854	9.929651	9.930443	60										
1	15	9.923152	9.923983	9.924809	9.925631	9.926447	9.927259	9.928065	9.928867	9.929664	59										
2	30	9.923166	9.923997	9.924823	9.925644	9.926461	9.927272	9.928079	9.928881	9.929678	58										
3	45	9.923179	9.924011	9.924837	9.925658	9.926474	9.927286	9.928092	9.928894	9.929691	57										
4	0	9.923193	9.924024	9.924850	9.925672	9.926488	9.927299	9.928106	9.928907	9.929704	56										
5	15	9.923207	9.924038	9.924864	9.925685	9.926501	9.927313	9.928119	9.928921	9.929717	55										
6	30	9.923221	9.924052	9.924878	9.925699	9.926515	9.927326	9.928133	9.928934	9.929731	54										
7	45	9.923235	9.924066	9.924892	9.925713	9.926529	9.927340	9.928146	9.928947	9.929744	53										
8	0	9.923249	9.924080	9.924905	9.925726	9.926542	9.927353	9.928159	9.928961	9.929757	52										
9	15	9.923263	9.924094	9.924919	9.925740	9.926556	9.927367	9.928173	9.928974	9.929770	51										
10	30	9.923277	9.924107	9.924933	9.925754	9.926569	9.927380	9.928186	9.928987	9.929784	50										
11	45	9.923291	9.924121	9.924946	9.925767	9.926583	9.927394	9.928199	9.929000	9.929797	49										
12	0	9.923304	9.924135	9.924960	9.925781	9.926596	9.927407	9.928213	9.929014	9.929810	48										
13	15	9.923318	9.924149	9.924974	9.925794	9.926610	9.927420	9.928226	9.929027	9.929823	47										
14	30	9.923332	9.924162	9.924988	9.925808	9.926623	9.927434	9.928240	9.929041	9.929836	46										
15	45	9.923346	9.924176	9.925001	9.925822	9.926637	9.927447	9.928253	9.929054	9.929850	45										
16	0	9.923360	9.924190	9.925015	9.925835	9.926651	9.927461	9.928266	9.929067	9.929863	44										
17	15	9.923374	9.924204	9.925029	9.925849	9.926664	9.927474	9.928280	9.929080	9.929876	43										
18	30	9.923388	9.924218	9.925043	9.925863	9.926678	9.927488	9.928293	9.929094	9.929889	42										
19	45	9.923402	9.924231	9.925056	9.925876	9.926681	9.927501	9.928307	9.929107	9.929902	41										
20	0	9.923415	9.924245	9.925070	9.925890	9.926705	9.927515	9.928320	9.929120	9.929916	40										
21	15	9.923429	9.924259	9.925084	9.925903	9.926718	9.927528	9.928333	9.929134	9.929929	39										
22	30	9.923443	9.924273	9.925097	9.925917	9.926732	9.927542	9.928347	9.929147	9.929942	38										
23	45	9.923457	9.924286	9.925111	9.925931	9.926745	9.927555	9.928360	9.929160	9.929955	37										
24	0	9.923471	9.924300	9.925125	9.925944	9.926759	9.927569	9.928374	9.929174	9.929969	36										
25	15	9.923485	9.924314	9.925138	9.925958	9.926772	9.927582	9.928387	9.929187	9.929982	35										
26	30	9.923499	9.924328	9.925152	9.925972	9.926786	9.927596	9.928400	9.929200	9.929995	34										
27	45	9.923512	9.924342	9.925166	9.925985	9.926799	9.927609	9.928413	9.929213	9.930008	33										
28	0	9.923526	9.924355	9.925180	9.925999	9.926813	9.927623	9.928427	9.929227	9.930021	32										
29	15	9.923540	9.924369	9.925193	9.926012	9.926826	9.927636	9.928440	9.929240	9.930035	31										
30	30	9.923554	9.924383	9.925207	9.926026	9.926840	9.927649	9.928454	9.929253	9.930048	30										
31	45	9.923568	9.924397	9.925221	9.926039	9.926854	9.927663	9.928467	9.929266	9.930061	29										
32	0	9.923582	9.924411	9.925234	9.926053	9.926867	9.927676	9.928480	9.929280	9.930074	28										
33	15	9.923596	9.924424	9.925248	9.926067	9.926881	9.927690	9.928494	9.929293	9.930087	27										
34	30	9.923610	9.924438	9.925262	9.926080	9.926894	9.927703	9.928507	9.929306	9.930101	26										
35	45	9.923623	9.924452	9.925275	9.926094	9.926908	9.927716	9.928520	9.929320	9.930114	25										
36	0	9.923637	9.924466	9.925289	9.926108	9.926921	9.927730	9.928534	9.929333	9.930127	24										
37	15	9.923651	9.924479	9.925303	9.926121	9.926935	9.927743	9.928547	9.929346	9.930140	23										
38	30	9.923665	9.924493	9.925316	9.926135	9.926948	9.927757	9.928561	9.929359	9.930153	22										
39	45	9.923679	9.924507	9.925330	9.926148	9.926962	9.927770	9.928574	9.929373	9.930167	21										
40	0	9.923693	9.924521	9.925344	9.926162	9.926975	9.927784	9.928587	9.929386	9.930180	20										
41	15	9.923706	9.924534	9.925357	9.926176	9.926989	9.927797	9.928601	9.929400	9.930193	19										
42	30	9.923720	9.924548	9.925371	9.926189	9.927002	9.927811	9.928614	9.929413	9.930206	18										
43	45	9.923734	9.924562	9.925385	9.926203	9.927016	9.927824	9.928627	9.929426	9.930219	17										
44	0	9.923748	9.924576	9.925398	9.926216	9.927029	9.927837	9.928641	9.929439	9.930233	16										
45	15	9.923762	9.924589	9.925412	9.926230	9.927043	9.927851	9.928654	9.929452	9.930246	15										
46	30	9.923776	9.924603	9.925426	9.926244	9.927056	9.927864	9.928667	9.929466	9.930259	14										
47	45	9.923789	9.924617	9.925439	9.926257	9.927070	9.927878	9.928681	9.929479	9.930272	13										
48	0	9.923803	9.924631	9.925453	9.926271	9.927083	9.927891	9.928694	9.929492	9.930285	12										
49	15	9.923817	9.924644	9.925467	9.926284	9.927097	9.927905	9.928707	9.929505	9.930298	11										
50	30	9.923831	9.924658	9.925480	9.926298	9.927110	9.927918	9.928721	9.929519	9.930312	10										
51	45	9.923845	9.924672	9.925494	9.926311	9.927124	9.927931	9.928734	9.929532	9.930325	9										
52	0	9.923859	9.924686	9.925508	9.926325	9.927137	9.927945	9.928747	9.929544	9.930338	8										
53	15	9.923872	9.924699	9.925521	9.926339	9.927151	9.927958	9.928761	9.929557	9.930351	7										
54	30	9.923886	9.924713	9.925535	9.926352	9.927164	9.927972	9.928774	9.929572	9.930364	6										
55	45	9.923900	9.924727	9.925549	9.926366	9.927178	9.927985	9.928787	9.929585	9.930377	5										
56	0	9.923914	9.924741	9.925562	9.926379	9.927191	9.927999	9.928801	9.929598	9.930391	4										
57	15	9.923928	9.924754	9.925576	9.926393	9.927205	9.928012	9.928814	9.929612	9.930404	3										
58	30	9.923942	9.924768	9.925590	9.926407	9.927218	9.928025	9.928827	9.929625	9.930417	2										
59	45	9.923955	9.924782	9.925603	9.926420	9.927232	9.928039	9.928841	9.929639	9.930430	1										

Log. Havensines. (1)

		9 ^h 0 ^m	9 ^h 4 ^m	9 ^h 8 ^m	9 ^h 12 ^m	9 ^h 16 ^m	9 ^h 20 ^m	9 ^h 24 ^m	9 ^h 28 ^m	9 ^h 32 ^m		
Time.	Arc	135°	136°	137°	138°	139°	140°	141°	142°	143°	Arc	Time.
		in	s									
0	0	0	9.931231	9.934332	9.937356	9.940303	9.943175	9.945972	9.948693	9.951340	9.953913	60
0	1	0	931283	934383	937406	940352	943223	946018	948738	951384	953955	59
0	2	0	931335	934434	937455	940400	943270	946064	948783	951427	953998	58
0	3	0	931388	934485	937505	940449	943317	946109	948827	951471	954040	57
0	4	0	931440	934536	937555	940497	943364	946155	948872	951514	954082	56
0	5	0	931492	934587	937604	940546	943411	946201	948917	951557	954124	55
0	6	0	931544	934638	937654	940594	943458	946247	948961	951601	954166	54
0	7	0	931596	934688	937704	940642	943505	946293	949006	951644	954209	53
0	8	0	931649	934739	937753	940691	943552	946339	949050	951687	954251	52
0	9	0	931701	934790	937803	940739	943600	946385	949095	951731	954293	51
0	10	0	931753	934841	937852	940787	943647	946430	949139	951774	954335	50
0	11	0	931805	934892	937902	940836	943694	946476	949184	951817	954377	49
0	12	0	931857	934943	937951	940884	943741	946522	949228	951861	954419	48
0	13	0	931909	934993	938001	940932	943788	946568	949273	951904	954461	47
0	14	0	931961	935044	938050	940980	943834	946613	949317	951947	954503	46
0	15	1	932013	935095	938100	941029	943881	946659	949362	951990	954545	45
1	16	1	932065	935146	938150	941077	943928	946705	949406	952033	954587	44
1	17	1	932117	935196	938199	941125	943975	946750	949451	952077	954629	43
1	18	1	932169	935247	938248	941173	944022	946796	949495	952120	954671	42
1	19	1	932221	935298	938297	941221	944069	946842	949539	952163	954713	41
1	20	1	932273	935348	938347	941269	944116	946887	949584	952206	954754	40
1	21	1	932325	935399	938396	941317	944163	946933	949628	952249	954796	39
1	22	1	932377	935449	938445	941365	944209	946978	949672	952292	954838	38
1	23	1	932429	935500	938495	941413	944256	947024	949717	952335	954880	37
1	24	1	932480	935551	938544	941461	944303	947069	949761	952378	954922	36
1	25	1	932532	935601	938593	941509	944350	947115	949805	952421	954964	35
1	26	1	932584	935652	938642	941557	944396	947160	949849	952464	955005	34
1	27	1	932636	935702	938692	941605	944443	947206	949893	952507	955047	33
1	28	1	932687	935753	938741	941653	944490	947251	949938	952550	955089	32
1	29	1	932739	935803	938790	941701	944536	947296	949982	952593	955130	31
1	30	2	932791	935853	938839	941749	944583	947342	950026	952636	955172	30
1	31	2	932843	935904	938888	941797	944629	947387	950070	952679	955214	29
2	32	2	932894	935954	938937	941845	944676	947432	950114	952722	955255	28
2	33	2	932946	936004	938986	941892	944723	947478	950158	952764	955297	27
2	34	2	932997	936055	939035	941940	944769	947523	950202	952807	955339	26
2	35	2	933049	936105	939085	941988	944816	947568	950246	952850	955380	25
2	36	2	933101	936155	939134	942036	944862	947613	950290	952893	955422	24
2	37	2	933152	936206	939183	942083	944909	947659	950334	952936	955463	23
2	38	2	933204	936256	939232	942131	944955	947704	950378	952978	955504	22
2	39	2	933255	936306	939280	942179	945001	947749	950422	953021	955546	21
2	40	2	933307	936356	939329	942226	945048	947794	950466	953064	955588	20
2	41	2	933358	936406	939378	942274	945094	947839	950510	953106	955629	19
2	42	2	933410	936457	939427	942322	945141	947884	950554	953149	955671	18
2	43	2	933461	936507	939476	942369	945187	947930	950598	953192	955712	17
2	44	2	933512	936557	939525	942417	945233	947975	950642	953234	955753	16
2	45	3	933564	936607	939574	942464	945280	948020	950685	953277	955795	15
2	46	3	933615	936657	939622	942512	945326	948065	950729	953319	955836	14
2	47	3	933666	936707	939671	942559	945372	948110	950773	953362	955877	13
2	48	3	933718	936757	939720	942607	945418	948155	950817	953404	955919	12
2	49	3	933769	936807	939769	942654	945465	948200	950860	953447	955960	11
2	50	3	933820	936857	939817	942702	945511	948245	950904	953489	956001	10
2	51	3	933871	936907	939866	942749	945557	948290	950948	953532	956042	9
2	52	3	933923	936957	939915	942797	945603	948335	950991	953574	956084	8
2	53	3	933974	937007	939964	942844	945649	948379	951035	953617	956125	7
2	54	3	934025	937057	940012	942891	945695	948424	951079	953659	956166	6
2	55	3	934076	937107	940061	942939	945741	948469	951122	953702	956207	5
2	56	3	934127	937157	940109	942986	945788	948514	951166	953744	956248	4
2	57	3	934179	937206	940158	943033	945834	948559	951210	953786	956289	3
2	58	3	934230	937256	940206	943081	945880	948604	951253	953829	956331	2
2	59	3	934281	937306	940255	943128	945926	948648	951297	953871	956372	1
2	60	4	934332	937356	940303	943175	945972	948693	951340	953913	956413	0
Time.	Arc	224°	223°	222°	221°	220°	219°	218°	217°	216°	Arc	Time.
		14 ^h 56 ^m	14 ^h 52 ^m	14 ^h 48 ^m	14 ^h 44 ^m	14 ^h 40 ^m	14 ^h 36 ^m	14 ^h 32 ^m	14 ^h 28 ^m	14 ^h 24 ^m		

Log. Haversines. (c)

Time.	Arc.	9 ^h 36 ^m	9 ^h 40 ^m	9 ^h 44 ^m	9 ^h 48 ^m	9 ^h 52 ^m	9 ^h 56 ^m	10 ^h 0 ^m	10 ^h 4 ^m	10 ^h 8 ^m	Arc.	Time.
		144°	145°	146°	147°	148°	149°	150°	151°	152°		
0 0 0		9.956413	9.958839	9.961193	9.963474	9.965683	9.967821	9.969887	9.971883	9.973808		60 0 4
0 0 1		9.956454	9.958879	9.961231	9.963511	9.965719	9.967856	9.969921	9.971916	9.973840		59 56 3
0 0 2		9.956495	9.958919	9.961270	9.963549	9.965756	9.967891	9.969955	9.971948	9.973871		58 52 3
0 12 3		9.956536	9.958958	9.961308	9.963586	9.965792	9.967926	9.969989	9.971981	9.973903		57 48 3
0 16 4		9.956577	9.958998	9.961347	9.963623	9.965828	9.967961	9.970023	9.972014	9.973934		56 44 3
0 20 5		9.956618	9.959038	9.961385	9.963661	9.965864	9.967996	9.970057	9.972046	9.973965		55 40 3
0 24 6		9.956659	9.959078	9.961424	9.963698	9.965900	9.968031	9.970090	9.972079	9.973997		54 36 3
0 28 7		9.956699	9.959117	9.961463	9.963735	9.965936	9.968066	9.970124	9.972111	9.974028		53 32 3
0 32 8		9.956740	9.959157	9.961501	9.963773	9.965972	9.968101	9.970158	9.972144	9.974060		52 28 3
0 36 9		9.956781	9.959197	9.961539	9.963810	9.966008	9.968136	9.970191	9.972176	9.974091		51 24 3
0 40 10		9.956822	9.959236	9.961578	9.963847	9.966045	9.968170	9.970225	9.972209	9.974122		50 20 3
0 44 11		9.956863	9.959276	9.961616	9.963884	9.966081	9.968205	9.970259	9.972241	9.974154		49 16 3
0 48 12		9.956904	9.959316	9.961655	9.963922	9.966117	9.968240	9.970292	9.972274	9.974185		48 12 3
0 52 13		9.956945	9.959355	9.961693	9.963959	9.966153	9.968275	9.970326	9.972306	9.974216		47 8 3
0 56 14		9.956985	9.959395	9.961731	9.963996	9.966188	9.968310	9.970360	9.972339	9.974247		46 4 3
1 0 15		9.957026	9.959434	9.961770	9.964033	9.966224	9.968344	9.970393	9.972371	9.974279		45 0 3
1 4 16		9.957067	9.959474	9.961808	9.964070	9.966260	9.968379	9.970427	9.972403	9.974310		44 56 2
1 8 17		9.957108	9.959513	9.961846	9.964107	9.966296	9.968414	9.970460	9.972436	9.974341		43 52 2
1 12 18		9.957148	9.959553	9.961885	9.964144	9.966332	9.968448	9.970493	9.972468	9.974372		42 48 2
1 16 19		9.957189	9.959592	9.961923	9.964181	9.966368	9.968483	9.970527	9.972500	9.974403		41 44 2
1 20 20		9.957230	9.959632	9.961961	9.964218	9.966404	9.968518	9.970561	9.972533	9.974434		40 40 2
1 24 21		9.957270	9.959671	9.961999	9.964255	9.966440	9.968552	9.970594	9.972565	9.974465		39 36 2
1 28 22		9.957311	9.959710	9.962037	9.964292	9.966475	9.968587	9.970628	9.972597	9.974496		38 32 2
1 32 23		9.957351	9.959750	9.962076	9.964329	9.966511	9.968622	9.970661	9.972629	9.974528		37 28 2
1 36 24		9.957392	9.959789	9.962114	9.964366	9.966547	9.968656	9.970694	9.972662	9.974559		36 24 2
1 40 25		9.957433	9.959828	9.962152	9.964403	9.966583	9.968691	9.970728	9.972694	9.974590		35 20 2
1 44 26		9.957473	9.959868	9.962190	9.964440	9.966618	9.968725	9.970761	9.972726	9.974621		34 16 2
1 48 27		9.957514	9.959907	9.962228	9.964477	9.966654	9.968760	9.970794	9.972758	9.974652		33 12 2
1 52 28		9.957554	9.959946	9.962266	9.964514	9.966690	9.968794	9.970828	9.972790	9.974683		32 8 2
1 56 29		9.957594	9.959986	9.962304	9.964551	9.966725	9.968829	9.970861	9.972822	9.974713		31 4 2
2 0 30		9.957635	9.960025	9.962342	9.964588	9.966761	9.968863	9.970894	9.972855	9.974744		30 0 2
2 4 31		9.957675	9.960064	9.962380	9.964624	9.966797	9.968898	9.970927	9.972887	9.974775		29 56 1
2 8 32		9.957716	9.960103	9.962418	9.964661	9.966832	9.968932	9.970961	9.972919	9.974806		28 52 1
2 12 33		9.957756	9.960142	9.962456	9.964698	9.966866	9.968966	9.970994	9.972951	9.974837		27 48 1
2 16 34		9.957797	9.960182	9.962494	9.964735	9.966903	9.96901	9.971027	9.972983	9.974868		26 44 1
2 20 35		9.957837	9.960221	9.962532	9.964771	9.966939	9.969035	9.971060	9.973015	9.974899		25 40 1
2 24 36		9.957877	9.960260	9.962570	9.964808	9.966974	9.969069	9.971093	9.973047	9.974930		24 36 1
2 28 37		9.957918	9.960299	9.962608	9.964845	9.967010	9.969104	9.971127	9.973079	9.974960		23 32 1
2 32 38		9.957958	9.960338	9.962646	9.964882	9.967045	9.969138	9.971160	9.973111	9.974991		22 28 1
2 36 39		9.957998	9.960377	9.962684	9.964918	9.967081	9.969172	9.971193	9.973142	9.975022		21 24 1
2 40 40		9.958038	9.960416	9.962722	9.964955	9.967116	9.969207	9.971226	9.973174	9.975053		20 20 1
2 44 41		9.958079	9.960455	9.962759	9.964991	9.967152	9.969241	9.971259	9.973206	9.975083		19 16 1
2 48 42		9.958119	9.960494	9.962797	9.965028	9.967187	9.969275	9.971292	9.973238	9.975114		18 12 1
2 52 43		9.958159	9.960533	9.962835	9.965065	9.967223	9.969309	9.971325	9.973270	9.975145		17 8 1
2 56 44		9.958199	9.960572	9.962873	9.965101	9.967258	9.969343	9.971358	9.973302	9.975175		16 4 1
3 0 45		9.958239	9.960611	9.962910	9.965138	9.967293	9.969378	9.971391	9.973334	9.975206		15 0 1
3 4 46		9.958279	9.960650	9.962948	9.965174	9.967329	9.969412	9.971424	9.973365	9.975237		14 56 0
3 8 47		9.958319	9.960689	9.962986	9.965211	9.967364	9.969446	9.971457	9.973397	9.975267		13 52 0
3 12 48		9.958360	9.960728	9.963023	9.965247	9.967399	9.969480	9.971490	9.973429	9.975298		12 48 0
3 16 49		9.958400	9.960767	9.963061	9.965284	9.967434	9.969514	9.971523	9.973461	9.975328		11 44 0
3 20 50		9.958440	9.960805	9.963099	9.965320	9.967470	9.969548	9.971555	9.973492	9.975359		10 40 0
3 24 51		9.958480	9.960844	9.963136	9.965356	9.967505	9.969582	9.971588	9.973524	9.975389		9 36 0
3 28 52		9.958520	9.960883	9.963174	9.965393	9.967540	9.969616	9.971621	9.973556	9.975420		8 32 0
3 32 53		9.958560	9.960922	9.963211	9.965429	9.967575	9.969650	9.971654	9.973587	9.975450		7 28 0
3 36 54		9.958600	9.960961	9.963249	9.965466	9.967610	9.969684	9.971687	9.973619	9.975481		6 24 0
3 40 55		9.958640	9.960999	9.963287	9.965502	9.967646	9.969718	9.971720	9.973651	9.975511		5 20 0
3 44 56		9.958680	9.961038	9.963324	9.965538	9.967681	9.969752	9.971752	9.973682	9.975542		4 16 0
3 48 57		9.958719	9.961077	9.963362	9.965575	9.967716	9.969786	9.971785	9.973714	9.975572		3 12 0
3 52 58		9.958759	9.961115	9.963399	9.965611	9.967751	9.969820	9.971818	9.973745	9.975602		2 8 0
3 56 59		9.958799	9.961154	9.963436	9.965647	9.967786	9.969854	9.971851	9.973777	9.975633		1 4 0
4 0 60		9.958839	9.961193	9.963474	9.965683	9.967821	9.969887	9.971883	9.973808	9.975663		0 0 0
Time.	Arc.	215°	214°	213°	212°	211°	210°	209°	208°	207°	Arc.	Time.
		14 ^h 20 ^m	14 ^h 16 ^m	14 ^h 12 ^m	14 ^h 8 ^m	14 ^h 4 ^m	14 ^h 0 ^m	13 ^h 56 ^m	13 ^h 52 ^m	13 ^h 48 ^m		

Log. Haversines. (1)

		10 ^h 12 ^m	10 ^h 16 ^m	10 ^h 20 ^m	10 ^h 24 ^m	10 ^h 28 ^m	10 ^h 32 ^m	10 ^h 36 ^m	10 ^h 40 ^m	10 ^h 44 ^m		
Time.	Arc.	153°	154°	155°	156°	157°	158°	159°	160°	161°	Arc.	Time.
m	s											m
0	0	9.975663	9.977448	9.979163	9.980809	9.982385	9.983893	9.985332	9.986703	9.988005	60	0
0	4	9.975693	9.977477	9.979191	9.980836	9.982411	9.983918	9.985356	9.986725	9.988027	59	3
0	8	9.975724	9.977506	9.979219	9.980862	9.982437	9.983942	9.985379	9.986747	9.988048	58	3
0	12	9.975754	9.977535	9.979247	9.980889	9.982462	9.983967	9.985402	9.986770	9.988069	57	48
0	16	9.975784	9.977564	9.979275	9.980916	9.982488	9.983991	9.985426	9.986792	9.988090	56	44
0	20	9.975814	9.977593	9.979303	9.980943	9.982514	9.984016	9.985449	9.986814	9.988111	55	40
0	24	9.975845	9.977623	9.979331	9.980970	9.982539	9.984040	9.985472	9.986836	9.988132	54	36
0	28	9.975875	9.977652	9.979359	9.980996	9.982565	9.984065	9.985496	9.986858	9.988153	53	32
0	32	9.975905	9.977681	9.979386	9.981023	9.982590	9.984089	9.985519	9.986881	9.988174	52	28
0	36	9.975935	9.977710	9.979414	9.981050	9.982616	9.984113	9.985542	9.986903	9.988195	51	24
0	40	9.975965	9.977739	9.979442	9.981076	9.982641	9.984138	9.985565	9.986925	9.988216	50	20
0	44	9.975995	9.977768	9.979470	9.981103	9.982667	9.984162	9.985589	9.986947	9.988237	49	16
0	48	9.976026	9.977796	9.979498	9.981130	9.982692	9.984186	9.985612	9.986969	9.988258	48	12
0	52	9.976056	9.977825	9.979525	9.981156	9.982718	9.984211	9.985635	9.986991	9.988279	47	8
0	56	9.976086	9.977854	9.979553	9.981183	9.982743	9.984235	9.985658	9.987013	9.988300	46	4
1	05	9.976116	9.977883	9.979581	9.981209	9.982769	9.984259	9.985681	9.987035	9.988320	45	0
1	4	9.976146	9.977912	9.979609	9.981236	9.982794	9.984284	9.985704	9.987057	9.988341	44	56
1	8	9.976176	9.977941	9.979636	9.981263	9.982820	9.984308	9.985728	9.987079	9.988362	43	52
1	12	9.976206	9.977970	9.979664	9.981289	9.982845	9.984332	9.985751	9.987101	9.988383	42	48
1	16	9.976236	9.977999	9.979692	9.981316	9.982870	9.984356	9.985774	9.987123	9.988404	41	44
1	20	9.976266	9.978027	9.979719	9.981342	9.982896	9.984380	9.985797	9.987145	9.988424	40	40
1	24	9.976296	9.978056	9.979747	9.981368	9.982921	9.984405	9.985820	9.987167	9.988445	39	36
1	28	9.976326	9.978085	9.979775	9.981395	9.982946	9.984429	9.985843	9.987188	9.988466	38	32
1	32	9.976355	9.978114	9.979802	9.981421	9.982972	9.984453	9.985866	9.987210	9.988487	37	28
1	36	9.976385	9.978142	9.979830	9.981448	9.982997	9.984477	9.985889	9.987232	9.988507	36	24
1	40	9.976415	9.978171	9.979857	9.981474	9.983022	9.984501	9.985912	9.987254	9.988528	35	20
1	44	9.976445	9.978200	9.979885	9.981500	9.983047	9.984525	9.985935	9.987276	9.988549	34	16
1	48	9.976475	9.978228	9.979912	9.981527	9.983072	9.984549	9.985958	9.987297	9.988569	33	12
1	52	9.976505	9.978257	9.979940	9.981553	9.983098	9.984573	9.985980	9.987319	9.988590	32	8
1	56	9.976534	9.978286	9.979967	9.981579	9.983123	9.984597	9.986003	9.987341	9.988611	31	4
2	00	9.976564	9.978314	9.979995	9.981606	9.983148	9.984621	9.986026	9.987363	9.988631	30	0
2	4	9.976594	9.978343	9.980022	9.981632	9.983173	9.984645	9.986049	9.987384	9.988652	29	56
2	8	9.976624	9.978371	9.980049	9.981658	9.983198	9.984669	9.986072	9.987406	9.988672	28	52
2	12	9.976653	9.978400	9.980077	9.981684	9.983223	9.984693	9.986095	9.987428	9.988693	27	48
2	16	9.976683	9.978428	9.980104	9.981711	9.983248	9.984717	9.986117	9.987449	9.988713	26	44
2	20	9.976713	9.978457	9.980131	9.981737	9.983273	9.984741	9.986140	9.987471	9.988734	25	40
2	24	9.976742	9.978485	9.980159	9.981763	9.983298	9.984765	9.986163	9.987493	9.988754	24	36
2	28	9.976772	9.978514	9.980186	9.981789	9.983323	9.984789	9.986186	9.987514	9.988775	23	32
2	32	9.976802	9.978542	9.980213	9.981815	9.983348	9.984813	9.986208	9.987536	9.988795	22	28
2	36	9.976831	9.978571	9.980241	9.981841	9.983373	9.984836	9.986231	9.987557	9.988816	21	24
2	40	9.976861	9.978599	9.980268	9.981868	9.983398	9.984860	9.986254	9.987579	9.988836	20	20
2	44	9.976890	9.978627	9.980295	9.981894	9.983423	9.984884	9.986276	9.987600	9.988856	19	16
2	48	9.976920	9.978656	9.980322	9.981920	9.983448	9.984908	9.986299	9.987622	9.988877	18	12
2	52	9.976950	9.978684	9.980350	9.981946	9.983473	9.984931	9.986321	9.987643	9.988897	17	8
2	56	9.976979	9.978712	9.980377	9.981972	9.983498	9.984955	9.986344	9.987665	9.988917	16	4
3	0	9.977008	9.978741	9.980404	9.981998	9.983523	9.984979	9.986367	9.987686	9.988938	15	0
3	4	9.977038	9.978769	9.980431	9.982024	9.983547	9.985003	9.986389	9.987708	9.988958	14	56
3	8	9.977067	9.978797	9.980458	9.982050	9.983572	9.985026	9.986412	9.987729	9.988978	13	52
3	12	9.977096	9.978826	9.980485	9.982076	9.983597	9.985050	9.986434	9.987750	9.988998	12	48
3	16	9.977126	9.978854	9.980512	9.982102	9.983622	9.985074	9.986457	9.987772	9.989019	11	44
3	20	9.977155	9.978882	9.980539	9.982127	9.983647	9.985097	9.986479	9.987793	9.989039	10	40
3	24	9.977185	9.978910	9.980566	9.982153	9.983671	9.985121	9.986502	9.987814	9.989059	9	36
3	28	9.977214	9.978938	9.980593	9.982179	9.983696	9.985144	9.986524	9.987836	9.989079	8	32
3	32	9.977243	9.978967	9.980620	9.982205	9.983721	9.985168	9.986547	9.987857	9.989099	7	28
3	36	9.977273	9.978995	9.980647	9.982231	9.983745	9.985191	9.986569	9.987878	9.989119	6	24
3	40	9.977302	9.979023	9.980674	9.982257	9.983770	9.985215	9.986591	9.987899	9.989140	5	20
3	44	9.977331	9.979051	9.980701	9.982282	9.983795	9.985238	9.986614	9.987921	9.989160	4	16
3	48	9.977360	9.979079	9.980728	9.982308	9.983819	9.985262	9.986636	9.987942	9.989180	3	12
3	52	9.977389	9.979107	9.980755	9.982334	9.983844	9.985285	9.986658	9.987963	9.989200	2	8
3	56	9.977419	9.979135	9.980781	9.982360	9.983869	9.985309	9.986681	9.987984	9.989220	1	4
4	0	9.977448	9.979163	9.980809	9.982385	9.983893	9.985332	9.986703	9.988005	9.989240	0	0
m	s											m
Time.	Arc.	206°	205°	204°	203°	202°	201°	200°	199°	198°	Arc.	Time.
		13 ^h 44 ^m	13 ^h 40 ^m	13 ^h 36 ^m	13 ^h 32 ^m	13 ^h 28 ^m	13 ^h 24 ^m	13 ^h 20 ^m	13 ^h 16 ^m	13 ^h 12 ^m		

Log. Haversines. (I)

Time	10 ^h 48 ^m		10 ^h 52 ^m		10 ^h 56 ^m		11 ^h 0 ^m		11 ^h 4 ^m		11 ^h 8 ^m		11 ^h 12 ^m		11 ^h 16 ^m		11 ^h 20 ^m		Time		
	Arc.	162°	Arc.	163°	Arc.	164°	Arc.	165°	Arc.	166°	Arc.	167°	Arc.	168°	Arc.	169°	Arc.	170°	Arc.		
0 0	0	9.989240	9.990407	9.991506	9.992537	9.993501	9.994399	9.995229	9.995992	9.996688	60	0	4						0 4		
0 4	1	9.989260	9.990425	9.991523	9.992554	9.993517	9.994413	9.995242	9.996004	9.996699	59	56	3						56 3		
0 8	2	9.989280	9.990444	9.991541	9.992570	9.993532	9.994427	9.995255	9.996016	9.996711	58	52	3						52 3		
0 12	3	9.989300	9.990463	9.991559	9.992587	9.993548	9.994442	9.995268	9.996028	9.996722	57	48	3						48 3		
0 16	4	9.989320	9.990482	9.991576	9.992604	9.993563	9.994456	9.995282	9.996040	9.996733	56	44	3						44 3		
0 20	5	9.989340	9.990501	9.991594	9.992620	9.993578	9.994470	9.995295	9.996053	9.996747	55	40	3						40 3		
0 24	6	9.989360	9.990519	9.991612	9.992637	9.993594	9.994485	9.995308	9.996065	9.996754	54	36	3						36 3		
0 28	7	9.989379	9.990538	9.991629	9.992653	9.993610	9.994499	9.995321	9.996077	9.996765	53	32	3						32 3		
0 32	8	9.989399	9.990557	9.991647	9.992670	9.993625	9.994513	9.995334	9.996089	9.996776	52	28	3						28 3		
0 36	9	9.989419	9.990576	9.991665	9.992686	9.993640	9.994527	9.995347	9.996101	9.996787	51	24	3						24 3		
0 40	10	9.989439	9.990594	9.991682	9.992703	9.993656	9.994542	9.995361	9.996113	9.996798	50	20	3						20 3		
0 44	11	9.989459	9.990613	9.991700	9.992719	9.993671	9.994556	9.995374	9.996125	9.996809	49	16	3						16 3		
0 48	12	9.989479	9.990632	9.991717	9.992735	9.993686	9.994570	9.995387	9.996137	9.996820	48	12	3						12 3		
0 52	13	9.989498	9.990650	9.991735	9.992752	9.993701	9.994584	9.995400	9.996149	9.996831	47	8	3						8 3		
0 56	14	9.989518	9.990669	9.991752	9.992768	9.993717	9.994598	9.995413	9.996160	9.996841	46	4	3						4 3		
1 0	15	9.989538	9.990688	9.991770	9.992785	9.993732	9.994612	9.995426	9.996172	9.996852	45	0	3						0 3		
1 4	16	9.989558	9.990706	9.991787	9.992801	9.993747	9.994626	9.995439	9.996184	9.996863	44	56	2						56 2		
1 8	17	9.989577	9.990725	9.991805	9.992817	9.993762	9.994641	9.995452	9.996196	9.996874	43	52	2						52 2		
1 12	18	9.989597	9.990743	9.991822	9.992833	9.993778	9.994655	9.995465	9.996208	9.996884	42	48	2						48 2		
1 16	19	9.989617	9.990762	9.991840	9.992850	9.993793	9.994669	9.995478	9.996220	9.996895	41	44	2						44 2		
1 20	20	9.989636	9.990780	9.991857	9.992866	9.993808	9.994683	9.995491	9.996232	9.996906	40	40	2						40 2		
1 24	21	9.989656	9.990800	9.991874	9.992882	9.993823	9.994697	9.995503	9.996243	9.996916	39	36	2						36 2		
1 28	22	9.989675	9.990817	9.991892	9.992899	9.993838	9.994711	9.995516	9.996255	9.996927	38	32	2						32 2		
1 32	23	9.989695	9.990836	9.991909	9.992915	9.993853	9.994725	9.995529	9.996267	9.996938	37	28	2						28 2		
1 36	24	9.989715	9.990854	9.991926	9.992931	9.993868	9.994739	9.995542	9.996279	9.996948	36	24	2						24 2		
1 40	25	9.989734	9.990873	9.991944	9.992947	9.993883	9.994753	9.995555	9.996290	9.996959	35	20	2						20 2		
1 44	26	9.989754	9.990891	9.991961	9.992963	9.993898	9.994767	9.995568	9.996302	9.996970	34	16	2						16 2		
1 48	27	9.989773	9.990909	9.991978	9.992979	9.993913	9.994780	9.995580	9.996314	9.996980	33	12	2						12 2		
1 52	28	9.989793	9.990928	9.991995	9.992995	9.993928	9.994794	9.995593	9.996325	9.996991	32	8	2						8 2		
1 56	29	9.989812	9.990946	9.992013	9.993012	9.993943	9.994808	9.995606	9.996337	9.997001	31	4	2						4 2		
2 0	30	9.989832	9.990964	9.992030	9.993028	9.993958	9.994822	9.995619	9.996349	9.997012	30	0	2						0 2		
2 4	31	9.989851	9.990983	9.992047	9.993044	9.993973	9.994836	9.995631	9.996360	9.997022	29	56	1						56 1		
2 8	32	9.989870	9.991001	9.992064	9.993060	9.993988	9.994850	9.995644	9.996372	9.997033	28	52	1						52 1		
2 12	33	9.989890	9.991019	9.992081	9.993076	9.994003	9.994863	9.995657	9.996383	9.997043	27	48	1						48 1		
2 16	34	9.989909	9.991038	9.992098	9.993092	9.994018	9.994877	9.995669	9.996395	9.997054	26	44	1						44 1		
2 20	35	9.989929	9.991056	9.992115	9.993108	9.994033	9.994891	9.995682	9.996406	9.997064	25	40	1						40 1		
2 24	36	9.989948	9.991074	9.992133	9.993124	9.994048	9.994905	9.995695	9.996418	9.997074	24	36	1						36 1		
2 28	37	9.989967	9.991092	9.992150	9.993140	9.994063	9.994918	9.995707	9.996429	9.997085	23	32	1						32 1		
2 32	38	9.989987	9.991110	9.992167	9.993156	9.994077	9.994932	9.995720	9.996441	9.997095	22	28	1						28 1		
2 36	39	9.990006	9.991129	9.992184	9.993172	9.994092	9.994946	9.995732	9.996452	9.997105	21	24	1						24 1		
2 40	40	9.990025	9.991147	9.992201	9.993187	9.994107	9.994959	9.995745	9.996464	9.997116	20	20	1						20 1		
2 44	41	9.990044	9.991165	9.992218	9.993203	9.994122	9.994973	9.995757	9.996475	9.997126	19	16	1						16 1		
2 48	42	9.990064	9.991183	9.992234	9.993219	9.994136	9.994987	9.995770	9.996487	9.997136	18	12	1						12 1		
2 52	43	9.990083	9.991201	9.992252	9.993235	9.994151	9.995000	9.995782	9.996498	9.997147	17	8	1						8 1		
2 56	44	9.990102	9.991219	9.992269	9.993251	9.994166	9.995014	9.995795	9.996509	9.997157	16	4	1						4 1		
3 0	45	9.990121	9.991237	9.992286	9.993267	9.994181	9.995027	9.995807	9.996521	9.997167	15	0	1						0 1		
3 4	46	9.990140	9.991255	9.992302	9.993282	9.994195	9.995041	9.995820	9.996532	9.997177	14	56	0						56 0		
3 8	47	9.990159	9.991273	9.992319	9.993298	9.994210	9.995055	9.995832	9.996543	9.997187	13	52	0						52 0		
3 12	48	9.990179	9.991291	9.992336	9.993314	9.994224	9.995068	9.995845	9.996554	9.997198	12	48	0						48 0		
3 16	49	9.990198	9.991309	9.992353	9.993330	9.994239	9.995082	9.995857	9.996566	9.997208	11	44	0						44 0		
3 20	50	9.990217	9.991327	9.992370	9.993345	9.994254	9.995095	9.995869	9.996577	9.997218	10	40	0						40 0		
3 24	51	9.990236	9.991345	9.992387	9.993361	9.994268	9.995108	9.995882	9.996588	9.997228	9	36	0						36 0		
3 28	52	9.990255	9.991362	9.992403	9.993377	9.994283	9.995122	9.995894	9.996599	9.997238	8	32	0						32 0		
3 32	53	9.990274	9.991381	9.992420	9.993392	9.994297	9.995135	9.995906	9.996611	9.997248	7	28	0						28 0		
3 36	54	9.990294	9.991399	9.992437	9.993408	9.994312	9.995149	9.995919	9.996622	9.997258	6	24	0						24 0		
3 40	55	9.990312	9.991417	9.992454	9.993424	9.994326	9.995162	9.995931	9.996633	9.997268	5	20	0						20 0		
3 44	56	9.990331	9.991434	9.992470	9.993439	9.994341	9.995175	9.995943	9.996644	9.997278	4	16	0						16 0		
3 48	57	9.990350	9.991452	9.992487	9.993455	9.994355	9.995189	9.995955	9.996655	9.997288	3	12	0						12 0		
3 52	58	9.990369	9.991470	9.992504	9.993470	9.994370	9.995202	9.995968	9.996666	9.997298	2	8	0						8 0		
3 56	59	9.990388	9.991488	9.992520	9.993486	9.994384	9.995215	9.995980	9.996677	9.997308	1	4	0						4 0		
4 0	60	9.990407	9.991506	9.992537	9.993501	9.994399	9.995229	9.995992	9.996688	9.997318	0	0	0						0 0		
Time.		Arc.	197°	Arc.	196°	Arc.	195°	Arc.	194°	Arc.	193°	Arc.	192°	Arc.	191°	Arc.	190°	Arc.	189°	Time.	
			13 ^h 8 ^m		13 ^h 4 ^m		13 ^h 0 ^m		12 ^h 56 ^m		12 ^h 52 ^m		12 ^h 48 ^m		12 ^h 44 ^m		12 ^h				

Log. Haversines. (t)

		11 ^h 24 ^m	11 ^h 28 ^m	11 ^h 32 ^m	11 ^h 36 ^m	11 ^h 40 ^m	11 ^h 44 ^m	11 ^h 48 ^m	11 ^h 52 ^m	11 ^h 56 ^m		
Time	Arc.	171°	172°	173°	174°	175°	176°	177°	178°	179°	Arc.	Time
0 0 0	6	9.997318	9.997882	9.998378	9.998809	9.999173	9.999471	9.999702	9.999868	9.999967	60	0 0 4
0 0 1	4	997328	997890	998386	998815	999178	999475	999706	999870	999968	59	56 3
0 0 2	8	997338	997899	998394	998822	999184	999480	999709	999872	999969	58	52 3
0 0 3	12	997348	997908	998401	998829	999189	999484	999712	999874	999970	57	48 3
0 16 4	9	9.997358	9.997917	9.998409	9.998835	9.999195	9.999488	9.999715	9.999876	9.999971	56	44 3
0 20 5	5	997368	997926	998417	998842	999200	999493	999719	999878	999972	55	40 3
0 24 6	6	997378	997934	998424	998848	999205	999497	999722	999881	999973	54	36 3
0 28 7	7	997387	997943	998432	998855	999211	999501	999725	999883	999974	53	32 3
0 32 8	9	9.997397	9.997952	9.998440	9.998861	9.999216	9.999505	9.999728	9.999885	9.999975	52	28 3
0 36 9	9	997407	997960	998447	998868	999222	999510	999731	999887	999976	51	24 3
0 40 10	10	997417	997969	998455	998874	999227	999514	999734	999889	999977	50	20 3
0 44 11	11	997427	997978	998462	998881	999232	999518	999738	999891	999978	49	16 3
0 48 12	12	9.997436	9.997986	9.998470	9.998887	9.999238	9.999522	9.999741	9.999893	9.999979	48	12 3
0 52 13	13	997446	997995	998477	998893	999243	999527	999744	999895	999980	47	8 3
0 56 14	14	997456	998003	998484	998900	999248	999531	999747	999897	999981	46	4 3
1 0 15	15	997465	998012	998492	998906	999254	999535	999750	999899	999981	45	0 3
1 4 16	16	9.997475	9.998021	9.998500	9.998912	9.999259	9.999539	9.999753	9.999901	9.999982	44	56 2
1 8 17	17	997485	998029	998507	998919	999264	999543	999756	999903	999983	43	52 2
1 12 18	18	997494	998038	998514	998925	999269	999547	999759	999904	999984	42	48 2
1 16 19	19	997504	998046	998522	998931	999274	999551	999762	999906	999985	41	44 2
1 20 20	20	9.997513	9.998055	9.998529	9.998938	9.999280	9.999555	9.999765	9.999908	9.999987	40	40 2
1 24 21	21	997523	998063	998537	998944	999285	999559	999768	999910	999986	39	36 2
1 28 22	22	997533	998071	998544	998950	999290	999563	999771	999912	999987	38	32 2
1 32 23	23	997542	998080	998551	998956	999295	999567	999774	999914	999987	37	28 2
1 36 24	24	9.997552	9.998088	9.998559	9.998962	9.999300	9.999571	9.999776	9.999915	9.999988	36	24 2
1 40 25	25	997561	998097	998566	998969	999305	999575	999779	999917	999989	35	20 2
1 44 26	26	997571	998105	998573	998975	999310	999579	999782	999919	999989	34	16 2
1 48 27	27	997580	998113	998580	998981	999315	999583	999785	999921	999990	33	12 2
1 52 28	28	9.997589	9.998122	9.998588	9.998987	9.999320	9.999587	9.999788	9.999922	9.999991	32	8 2
1 56 29	29	997599	998130	998595	998993	999325	999591	999791	999924	999991	31	4 2
2 0 30	30	997608	998138	998602	998999	999330	999595	999793	999926	999992	30	0 2
2 4 31	31	997618	998147	998609	999005	999335	999599	999796	999927	999992	29	56 1
2 8 32	32	9.997627	9.998155	9.998616	9.999011	9.999340	9.999602	9.999799	9.999929	9.999993	28	52 1
2 12 33	33	997636	998163	998623	999017	999345	999606	999801	999930	999993	27	48 1
2 16 34	34	997646	998171	998630	999023	999350	999610	999804	999932	999994	26	44 1
2 20 35	35	997655	998179	998638	999029	999355	999614	999807	999934	999994	25	40 1
2 24 36	36	9.997664	9.998188	9.998645	9.999035	9.999360	9.999618	9.999809	9.999935	9.999995	24	36 1
2 28 37	37	997674	998195	998652	999041	999364	999621	999812	999937	999995	23	32 1
2 32 38	38	997683	998204	998659	999047	999369	999625	999814	999938	999996	22	28 1
2 36 39	39	997692	998212	998666	999053	999374	999629	999817	999940	999996	21	24 1
2 40 40	40	9.997701	9.998220	9.998673	9.999059	9.999379	9.999632	9.999820	9.999941	9.999996	20	20 1
2 44 41	41	997710	998228	998680	999065	999384	999636	999822	999943	999997	19	16 1
2 48 42	42	997720	998236	998687	999071	999388	999640	999825	999944	999997	18	12 1
2 52 43	43	997729	998244	998694	999076	999393	999643	999828	999946	999997	17	8 1
2 56 44	44	9.997738	9.998252	9.998701	9.999082	9.999398	9.999647	9.999830	9.999947	9.999998	16	4 1
3 0 45	45	997747	998260	998707	999088	999402	999651	999832	999948	999998	15	0 1
3 4 46	46	997756	998268	998714	999094	999407	999654	999835	999950	999998	14	56 0
3 8 47	47	997765	998276	998721	999100	999412	999658	999837	999951	999998	13	52 0
3 12 48	48	9.997774	9.998284	9.998728	9.999105	9.999416	9.999661	9.999840	9.999952	9.999999	12	48 0
3 16 49	49	997783	998292	998735	999111	999421	999665	999842	999954	999999	11	44 0
3 20 50	50	997792	998300	998742	999116	999426	999668	999845	999955	999999	10	40 0
3 24 51	51	997801	998308	998748	999123	999430	999672	999847	999956	999999	9	36 0
3 28 52	52	9.997810	9.998316	9.998755	9.999128	9.999434	9.999675	9.999849	9.999958	9.999999	8	32 0
3 32 53	53	997819	998324	998762	999134	999439	999679	999852	999959	10.000000	7	28 0
3 36 54	54	997828	998332	998769	999139	999444	999682	999854	999960	10.000000	6	24 0
3 40 55	55	997837	998340	998775	999145	999448	999686	999856	999961	10.000000	5	20 0
3 44 56	56	9.997846	9.998347	9.998782	9.999151	9.999453	9.999689	9.999859	9.999962	10.000000	4	16 0
3 48 57	57	997855	998355	998789	999156	999457	999692	999861	999964	10.000000	3	12 0
3 52 58	58	997864	998363	998796	999162	999462	999696	999863	999965	10.000000	2	8 0
3 56 59	59	997873	998371	998802	999167	999466	999699	999865	999966	10.000000	1	4 0
4 0 60	60	9.997882	9.998378	9.998809	9.999173	9.999471	9.999702	9.999868	9.999967	10.000000	0	0 0 0
Time	Arc.	188°	187°	186°	185°	184°	183°	182°	181°	180°	Arc.	Time
		12 ^h 32 ^m	12 ^h 28 ^m	12 ^h 24 ^m	12 ^h 20 ^m	12 ^h 16 ^m	12 ^h 12 ^m	12 ^h 8 ^m	12 ^h 4 ^m	12 ^h 0 ^m		

Log^s. of numbers from one to a thousand.

(u.)

No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.
1	.000000	73	.863323	145	.161368	217	.336460	289	.460393	361	.557507	433	.636488
2	.301030	74	.869232	146	.164353	218	.338457	290	.462398	362	.558709	434	.637490
3	.477121	75	.875061	147	.167317	219	.340444	291	.463393	363	.559907	435	.638489
4	.602060	76	.880814	148	.170262	220	.342423	292	.465383	364	.561101	436	.639486
5	.698970	77	.886491	149	.173186	221	.344392	293	.466368	365	.562293	437	.640481
6	.778151	78	.892095	150	.176091	222	.346353	294	.468347	366	.563481	438	.641474
7	.845098	79	.897627	151	.178977	223	.348305	295	.469822	367	.564666	439	.642465
8	.903090	80	.903090	152	.181844	224	.350248	296	.471292	368	.565848	440	.643453
9	.954243	81	.908485	153	.184691	225	.352183	297	.472756	369	.567026	441	.644439
10	.000000	82	.913814	154	.187521	226	.354108	298	.474216	370	.568202	442	.645422
11	.041393	83	.919078	155	.190332	227	.356026	299	.475671	371	.569374	443	.646404
12	.079181	84	.924279	156	.193125	228	.357935	300	.477121	372	.570543	444	.647383
13	.113943	85	.929419	157	.195900	229	.359835	301	.478567	373	.571709	445	.648360
14	.146128	86	.934498	158	.198657	230	.361728	302	.480007	374	.572872	446	.649335
15	.176091	87	.939519	159	.201397	231	.363612	303	.481443	375	.574031	447	.650308
16	.204120	88	.944483	160	.204120	232	.365488	304	.482874	376	.575188	448	.651278
17	.230449	89	.949390	161	.206826	233	.367356	305	.484300	377	.576341	449	.652246
18	.255273	90	.954243	162	.209515	234	.369216	306	.485721	378	.577492	450	.653217
19	.278754	91	.959041	163	.212188	235	.371068	307	.487138	379	.578639	451	.654171
20	.301030	92	.963788	164	.214844	236	.372912	308	.488551	380	.579784	452	.655138
21	.322219	93	.968483	165	.217484	237	.374748	309	.489958	381	.580925	453	.656098
22	.342423	94	.973128	166	.220106	238	.376577	310	.491362	382	.582063	454	.657056
23	.361728	95	.977724	167	.222716	239	.378398	311	.492760	383	.583199	455	.658011
24	.380211	96	.982271	168	.225309	240	.380217	312	.494155	384	.584331	456	.658965
25	.397940	97	.986772	169	.227887	241	.382017	313	.495544	385	.585461	457	.659916
26	.414973	98	.991226	170	.230449	242	.383815	314	.496930	386	.586587	458	.660865
27	.431364	99	.995635	171	.232996	243	.385606	315	.498311	387	.587711	459	.661813
28	.447158	100	.000000	172	.235528	244	.387390	316	.499687	388	.588832	460	.662758
29	.462398	101	.004321	173	.238046	245	.389166	317	.501059	389	.589950	461	.663701
30	.477121	102	.008600	174	.240549	246	.390935	318	.502427	390	.591065	462	.664642
31	.491362	103	.012837	175	.243038	247	.392697	319	.503791	391	.592177	463	.665581
32	.505150	104	.017033	176	.245513	248	.394452	320	.505150	392	.593266	464	.666518
33	.518514	105	.021189	177	.247973	249	.396199	321	.506505	393	.594333	465	.667453
34	.531479	106	.025306	178	.250420	250	.397940	322	.507856	394	.595406	466	.668386
35	.544068	107	.029384	179	.252853	251	.399674	323	.509203	395	.596597	467	.669317
36	.556303	108	.033424	180	.255273	252	.401401	324	.510545	396	.597695	468	.670246
37	.568202	109	.037427	181	.257679	253	.403121	325	.511883	397	.598791	469	.671173
38	.579784	110	.041393	182	.260071	254	.404834	326	.513218	398	.599883	470	.672098
39	.591065	111	.045323	183	.262451	255	.406540	327	.514548	399	.600973	471	.673021
40	.602060	112	.049218	184	.264818	256	.408240	328	.515874	400	.602060	472	.673942
41	.612784	113	.053078	185	.267172	257	.409933	329	.517196	401	.603144	473	.674861
42	.623249	114	.056905	186	.269513	258	.411620	330	.518514	402	.604226	474	.675778
43	.633468	115	.060698	187	.271842	259	.413300	331	.519828	403	.605305	475	.676694
44	.643453	116	.064458	188	.274158	260	.414973	332	.521138	404	.606381	476	.677607
45	.653213	117	.068186	189	.276462	261	.416641	333	.522444	405	.607455	477	.678518
46	.662758	118	.071882	190	.278754	262	.418301	334	.523746	406	.608526	478	.679428
47	.672098	119	.075547	191	.281033	263	.419956	335	.525045	407	.609594	479	.680336
48	.681241	120	.079181	192	.283301	264	.421604	336	.526339	408	.610660	480	.681241
49	.690196	121	.082785	193	.285557	265	.423246	337	.527630	409	.611723	481	.682145
50	.698970	122	.086360	194	.287802	266	.424882	338	.528917	410	.612784	482	.683047
51	.707570	123	.089905	195	.290035	267	.426511	339	.530200	411	.613842	483	.683947
52	.716003	124	.093422	196	.292256	268	.428135	340	.531479	412	.614897	484	.684845
53	.724276	125	.096910	197	.294466	269	.429752	341	.532754	413	.615950	485	.685742
54	.732394	126	.100371	198	.296665	270	.431364	342	.534026	414	.617000	486	.686636
55	.740363	127	.103804	199	.298853	271	.432960	343	.535294	415	.618048	487	.687529
56	.748188	128	.107210	200	.301030	272	.434569	344	.536558	416	.619093	488	.688420
57	.755875	129	.110590	201	.303196	273	.436163	345	.537819	417	.620136	489	.689309
58	.763428	130	.113943	202	.305351	274	.437751	346	.539076	418	.621176	490	.690196
59	.770852	131	.117271	203	.307496	275	.439333	347	.540329	419	.622214	491	.691081
60	.778151	132	.120574	204	.309630	276	.440909	348	.541579	420	.623249	492	.691965
61	.785330	133	.123852	205	.311754	277	.442480	349	.542825	421	.624282	493	.692847
62	.792392	134	.127105	206	.313867	278	.444045	350	.544068	422	.625312	494	.693727
63	.799341	135	.130334	207	.315970	279	.445604	351	.545307	423	.626340	495	.694605
64	.806180	136	.133539	208	.318063	280	.447158	352	.546543	424	.627366	496	.695482
65	.812913	137	.136721	209	.320146	281	.448706	353	.547775	425	.628389	497	.696356
66	.819544	138	.139879	210	.322219	282	.450249	354	.549003	426	.629410	498	.697229
67	.826075	139	.143015	211	.324282	283	.451786	355	.550228	427	.630428	499	.698101
68	.832509	140	.146128	212	.326336	284	.453318	356	.551450	428	.631444	500	.698970
69	.838949	141	.149219	213	.328380	285	.454845	357	.552668	429	.632457	501	.699838
70	.845098	142	.152288	214	.330414	286	.456366	358	.553883	430	.633468	502	.700704
71	.851258	143	.155336	215	.332438	287	.457882	359	.555094	431	.634477	503	.701568
72	.857333	144	.158362	216	.334454	288	.459392	360	.556303	432	.635484	504	.702431

Log^s. of numbers from one to a thousand.

(u.)

No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.
505	.703291	576	.760422	647	.810904	718	.856124	789	.897077	860	.934498
506	.704151	577	.761176	648	.811575	719	.856729	790	.897627	861	.935003
507	.705008	578	.761928	649	.812245	720	.857333	791	.898176	862	.935507
508	.705864	579	.762679	650	.812913	721	.857935	792	.898725	863	.936011
509	.706718	580	.763428	651	.813581	722	.858537	793	.899273	864	.936514
510	.707570	581	.764176	652	.814248	723	.859138	794	.899821	865	.937016
511	.708421	582	.764923	653	.814913	724	.859739	795	.900367	866	.937518
512	.709270	583	.765669	654	.815578	725	.860338	796	.900913	867	.938019
513	.710117	584	.766413	655	.816241	726	.860937	797	.901458	868	.938520
514	.710963	585	.767156	656	.816904	727	.861534	798	.902003	869	.939020
515	.711807	586	.767898	657	.817565	728	.862131	799	.902547	870	.939519
516	.712650	587	.768638	658	.818226	729	.862728	800	.903090	871	.940018
517	.713491	588	.769377	659	.818885	730	.863323	801	.903633	872	.940516
518	.714330	589	.770115	660	.819544	731	.863917	802	.904174	873	.941014
519	.715167	590	.770852	661	.820201	732	.864511	803	.904716	874	.941511
520	.716003	591	.771587	662	.820858	733	.865104	804	.905256	875	.942008
521	.716838	592	.772322	663	.821514	734	.865696	805	.905796	876	.942504
522	.717671	593	.773055	664	.822168	735	.866287	806	.906335	877	.943000
523	.718502	594	.773786	665	.822822	736	.866878	807	.906874	878	.943495
524	.719331	595	.774517	666	.823474	737	.867467	808	.907411	879	.943989
525	.720159	596	.775246	667	.824126	738	.868056	809	.907949	880	.944483
526	.720986	597	.775974	668	.824776	739	.868644	810	.908485	881	.944976
527	.721811	598	.776701	669	.825426	740	.869232	811	.909021	882	.945469
528	.722634	599	.777427	670	.826075	741	.869818	812	.909556	883	.945961
529	.723456	600	.778151	671	.826723	742	.870404	813	.910091	884	.946452
530	.724276	601	.778874	672	.827369	743	.870989	814	.910624	885	.946943
531	.725095	602	.779596	673	.828015	744	.871573	815	.911158	886	.947434
532	.725912	603	.780317	674	.828660	745	.872156	816	.911690	887	.947924
533	.726727	604	.781037	675	.829304	746	.872739	817	.912222	888	.948413
534	.727541	605	.781755	676	.829947	747	.873321	818	.912753	889	.948902
535	.728354	606	.782473	677	.830589	748	.873902	819	.913284	890	.949390
536	.729165	607	.783189	678	.831230	749	.874482	820	.913814	891	.949878
537	.729974	608	.783904	679	.831870	750	.875061	821	.914343	892	.950365
538	.730782	609	.784617	680	.832509	751	.875640	822	.914872	893	.950851
539	.731589	610	.785330	681	.833147	752	.876218	823	.915400	894	.951338
540	.732394	611	.786041	682	.833784	753	.876795	824	.915927	895	.951823
541	.733197	612	.786751	683	.834421	754	.877371	825	.916454	896	.952308
542	.733999	613	.787460	684	.835056	755	.877947	826	.916980	897	.952792
543	.734800	614	.788168	685	.835691	756	.878522	827	.917506	898	.953276
544	.735599	615	.788875	686	.836324	757	.879096	828	.918030	899	.953760
545	.736397	616	.789581	687	.836957	758	.879669	829	.918555	900	.954243
546	.737193	617	.790285	688	.837588	759	.880242	830	.919078	901	.954725
547	.737987	618	.790988	689	.838219	760	.880814	831	.919601	902	.955207
548	.738781	619	.791691	690	.838849	761	.881385	832	.920123	903	.955688
549	.739572	620	.792392	691	.839478	762	.881955	833	.920645	904	.956168
550	.740363	621	.793092	692	.840106	763	.882525	834	.921166	905	.956649
551	.741152	622	.793790	693	.840733	764	.883093	835	.921686	906	.957128
552	.741939	623	.794488	694	.841359	765	.883661	836	.922206	907	.957607
553	.742725	624	.795185	695	.841985	766	.884229	837	.922725	908	.958086
554	.743510	625	.795880	696	.842609	767	.884795	838	.923244	909	.958564
555	.744293	626	.796574	697	.843233	768	.885361	839	.923762	910	.959041
556	.745075	627	.797268	698	.843855	769	.885926	840	.924279	911	.959518
557	.745855	628	.797960	699	.844477	770	.886491	841	.924796	912	.959995
558	.746634	629	.798651	700	.845098	771	.887054	842	.925312	913	.960471
559	.747412	630	.799341	701	.845718	772	.887617	843	.925828	914	.960946
560	.748188	631	.800029	702	.846337	773	.888179	844	.926342	915	.961421
561	.748963	632	.800717	703	.846955	774	.888741	845	.926857	916	.961895
562	.749736	633	.801404	704	.847573	775	.889302	846	.927370	917	.962369
563	.750508	634	.802089	705	.848189	776	.889862	847	.927883	918	.962843
564	.751279	635	.802774	706	.848805	777	.890421	848	.928396	919	.963316
565	.752048	636	.803457	707	.849419	778	.890980	849	.928908	920	.963788
566	.752816	637	.804139	708	.850033	779	.891537	850	.929419	921	.964260
567	.753583	638	.804821	709	.850646	780	.892095	851	.929930	922	.964731
568	.754348	639	.805501	710	.851258	781	.892651	852	.930440	923	.965202
569	.755112	640	.806180	711	.851870	782	.893207	853	.930949	924	.965672
570	.755875	641	.806858	712	.852480	783	.893762	854	.931458	925	.966142
571	.756636	642	.807535	713	.853090	784	.894316	855	.931966	926	.966611
572	.757396	643	.808211	714	.853698	785	.894870	856	.932474	927	.967080
573	.758155	644	.808886	715	.854306	786	.895423	857	.932981	928	.967548
574	.758912	645	.809560	716	.854913	787	.895975	858	.933487	929	.968016
575	.759668	646	.810233	717	.855519	788	.896526	859	.933993	930	.968483

Log. .000000 to .130012

No. 1000 to 1349.

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No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
1000	.000000	000	1070	.029384	000	1140	.056905	000	1210	.082785	000	1280	.107210	000
1	.000434	043	1	.029789	040	1	.057286	038	1	.083144	036	1	.107549	034
2	.000868	086	2	.030195	081	2	.057666	076	2	.083503	071	2	.107888	067
3	.001301	130	3	.030600	121	3	.058046	114	3	.083861	107	3	.108227	101
4	.001734	173	4	.031004	162	4	.058426	152	4	.084219	143	4	.108565	135
5	.002166	216	5	.031408	202	5	.058805	190	5	.084576	179	5	.108903	169
6	.002598	259	6	.031812	242	6	.059185	228	6	.084934	214	6	.109241	203
7	.003029	303	7	.032216	283	7	.059563	266	7	.085291	250	7	.109578	237
8	.003460	346	8	.032619	323	8	.059942	304	8	.085647	286	8	.109916	270
9	.003891	389	9	.033021	364	9	.060320	342	9	.086004	322	9	.110253	304
1010	.004321	000	1080	.033424	000	1150	.060698	000	1220	.086360	000	1290	.110590	000
1	.004751	043	1	.033826	040	1	.061075	038	1	.086716	035	1	.110926	034
2	.005180	086	2	.034227	080	2	.061452	075	2	.087071	071	2	.111262	067
3	.005609	128	3	.034628	120	3	.061829	113	3	.087426	106	3	.111598	101
4	.006038	171	4	.035029	160	4	.062206	150	4	.087781	142	4	.111934	134
5	.006466	214	5	.035430	200	5	.062582	188	5	.088136	177	5	.112270	168
6	.006894	257	6	.035830	240	6	.062958	226	6	.088490	213	6	.112605	201
7	.007321	300	7	.036229	280	7	.063333	263	7	.088845	248	7	.112940	235
8	.007748	343	8	.036629	321	8	.063709	301	8	.089198	284	8	.113275	268
9	.008174	385	9	.037028	361	9	.064083	338	9	.089552	319	9	.113609	302
1020	.008600	000	1090	.037426	000	1160	.064458	000	1230	.089905	000	1300	.113943	000
1	.009026	042	1	.037825	040	1	.064832	037	1	.090258	035	1	.114277	033
2	.009451	085	2	.038223	079	2	.065206	075	2	.090611	070	2	.114611	067
3	.009876	127	3	.038620	119	3	.065580	112	3	.090963	106	3	.114944	100
4	.010300	170	4	.039017	159	4	.065953	149	4	.091315	141	4	.115278	133
5	.010724	212	5	.039414	198	5	.066326	186	5	.091667	176	5	.115610	167
6	.011147	254	6	.039811	238	6	.066699	224	6	.092018	211	6	.115943	200
7	.011570	297	7	.040207	278	7	.067071	261	7	.092370	246	7	.116276	233
8	.011993	339	8	.040602	318	8	.067443	298	8	.092721	282	8	.116608	267
9	.012415	382	9	.040998	357	9	.067814	336	9	.093071	317	9	.116940	300
1030	.012837	000	1100	.041393	000	1170	.068186	000	1240	.093422	000	1310	.117271	000
1	.013259	042	1	.041787	039	1	.068557	037	1	.093772	035	1	.117603	033
2	.013680	084	2	.042182	079	2	.068928	074	2	.094122	070	2	.117934	066
3	.014100	126	3	.042575	118	3	.069298	111	3	.094471	105	3	.118265	099
4	.014520	168	4	.042969	157	4	.069668	148	4	.094820	140	4	.118595	132
5	.014940	210	5	.043362	196	5	.070038	185	5	.095169	175	5	.118926	165
6	.015360	252	6	.043755	236	6	.070407	222	6	.095518	210	6	.119256	198
7	.015779	294	7	.044148	275	7	.070776	259	7	.095866	245	7	.119586	231
8	.016197	336	8	.044540	314	8	.071145	296	8	.096215	280	8	.119915	264
9	.016615	378	9	.044931	354	9	.071514	333	9	.096562	315	9	.120245	297
1040	.017033	000	1110	.045323	000	1180	.071882	000	1250	.096910	000	1320	.120574	000
1	.017451	042	1	.045714	039	1	.072250	037	1	.097257	035	1	.120903	033
2	.017868	083	2	.046105	078	2	.072617	073	2	.097604	069	2	.121231	066
3	.018284	125	3	.046495	117	3	.072985	110	3	.097951	104	3	.121560	098
4	.018700	166	4	.046885	156	4	.073352	147	4	.098297	138	4	.121888	131
5	.019116	208	5	.047275	195	5	.073718	183	5	.098644	173	5	.122216	164
6	.019532	250	6	.047664	234	6	.074085	220	6	.098990	208	6	.122543	197
7	.019947	291	7	.048053	273	7	.074451	256	7	.099335	240	7	.122871	230
8	.020361	333	8	.048442	312	8	.074816	293	8	.099681	277	8	.123198	262
9	.020775	374	9	.048830	351	9	.075182	330	9	.100026	311	9	.123525	295
1050	.021189	000	1120	.049218	000	1190	.075547	000	1260	.100370	000	1330	.123852	000
1	.021603	041	1	.049606	039	1	.075912	036	1	.100715	034	1	.124178	033
2	.022016	082	2	.049993	077	2	.076276	073	2	.101059	069	2	.124504	065
3	.022428	124	3	.050380	116	3	.076640	109	3	.101403	103	3	.124830	098
4	.022841	165	4	.050766	154	4	.077004	145	4	.101747	137	4	.125156	130
5	.023252	206	5	.051152	193	5	.077368	181	5	.102090	172	5	.125481	163
6	.023664	247	6	.051538	232	6	.077731	218	6	.102434	206	6	.125806	195
7	.024075	288	7	.051924	270	7	.078094	254	7	.102777	240	7	.126131	228
8	.024486	330	8	.052309	309	8	.078457	290	8	.103119	275	8	.126456	260
9	.024896	371	9	.052694	347	9	.078819	327	9	.103462	309	9	.126781	293
1060	.025306	000	1130	.053078	000	1200	.079181	000	1270	.103804	000	1340	.127105	000
1	.025715	041	1	.053463	038	1	.079543	036	1	.104146	034	1	.127429	032
2	.026124	082	2	.053846	077	2	.079904	072	2	.104487	068	2	.127752	065
3	.026533	122	3	.054230	115	3	.080266	108	3	.104828	102	3	.128076	097
4	.026942	163	4	.054613	153	4	.080626	144	4	.105169	136	4	.128399	129
5	.027350	204	5	.054996	191	5	.080987	180	5	.105510	170	5	.128722	161
6	.027757	245	6	.055378	230	6	.081347	216	6	.105851	204	6	.129045	194
7	.028164	286	7	.055760	268	7	.081707	252	7	.106191	238	7	.129368	226
8	.028571	326	8	.056142	306	8	.082067	288	8	.106531	272	8	.129690	258
9	.028978	367	9	.056524	345	9	.082426	324	9	.106870	306	9	.130012	291

Log. .130334 to .230193

No. 1350 to 1699.

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No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
1359	.130334	000	1420	.152288	000	1490	.173186	000	1560	.193125	000	1630	.212188	000
1	.130655	032	1	.152594	030	1	.173478	029	1	.193403	028	1	.212454	027
2	.130977	064	2	.152900	061	2	.173769	058	2	.193681	056	2	.212720	053
3	.131298	096	3	.153205	091	3	.174060	087	3	.193959	083	3	.212986	080
4	.131619	128	4	.153510	122	4	.174351	116	4	.194237	111	4	.213252	106
5	.131939	160	5	.153815	152	5	.174641	145	5	.194514	139	5	.213518	133
6	.132260	192	6	.154119	183	6	.174932	175	6	.194792	166	6	.213783	159
7	.132580	224	7	.154424	213	7	.175222	204	7	.195069	194	7	.214049	186
8	.132900	256	8	.154728	244	8	.175512	233	8	.195346	222	8	.214314	212
9	.133219	288	9	.155032	274	9	.175802	261	9	.195623	250	9	.214579	239
1360	.133539	000	1430	.155336	000	1500	.176091	000	1570	.195900	000	1640	.214844	000
1	.133858	032	1	.155640	030	1	.176381	029	1	.196176	027	1	.215109	026
2	.134177	064	2	.155943	060	2	.176670	058	2	.196452	055	2	.215373	053
3	.134496	096	3	.156246	091	3	.176959	086	3	.196729	083	3	.215638	079
4	.134814	127	4	.156549	121	4	.177248	115	4	.197005	110	4	.215902	106
5	.135133	159	5	.156852	151	5	.177536	144	5	.197281	138	5	.216166	132
6	.135451	191	6	.157154	181	6	.177825	173	6	.197556	166	6	.216430	158
7	.135768	223	7	.157457	211	7	.178113	202	7	.197832	193	7	.216694	185
8	.136086	255	8	.157759	242	8	.178401	231	8	.198107	221	8	.216957	211
9	.136403	287	9	.158061	272	9	.178689	259	9	.198382	248	9	.217221	238
1370	.136721	000	1440	.158362	000	1510	.178977	000	1580	.198657	000	1650	.217484	000
1	.137037	032	1	.158664	030	1	.179264	029	1	.198932	027	1	.217747	026
2	.137354	063	2	.158965	060	2	.179552	057	2	.199206	055	2	.218010	052
3	.137670	094	3	.159266	090	3	.179839	086	3	.199481	082	3	.218273	079
4	.137987	126	4	.159567	120	4	.180126	115	4	.199755	110	4	.218535	105
5	.138303	158	5	.159868	150	5	.180413	144	5	.200029	137	5	.218798	131
6	.138618	189	6	.160168	180	6	.180699	172	6	.200303	164	6	.219060	157
7	.138934	221	7	.160468	210	7	.180986	201	7	.200577	192	7	.219322	183
8	.139249	252	8	.160769	240	8	.181272	230	8	.200850	219	8	.219584	210
9	.139564	284	9	.161068	270	9	.181558	258	9	.201124	247	9	.219846	236
1380	.139879	000	1450	.161368	000	1520	.181844	000	1590	.201397	000	1660	.220108	000
1	.140194	031	1	.161667	030	1	.182129	028	1	.201670	027	1	.220370	026
2	.140508	063	2	.161967	060	2	.182415	057	2	.201943	054	2	.220631	052
3	.140822	094	3	.162266	089	3	.182700	086	3	.202216	082	3	.220892	078
4	.141136	125	4	.162564	119	4	.182985	114	4	.202488	109	4	.221153	104
5	.141450	157	5	.162863	149	5	.183270	143	5	.202761	136	5	.221414	130
6	.141763	188	6	.163161	179	6	.183554	171	6	.203033	163	6	.221675	157
7	.142076	219	7	.163460	209	7	.183839	200	7	.203305	191	7	.221936	183
8	.142389	251	8	.163757	239	8	.184123	228	8	.203577	218	8	.222196	209
9	.142702	282	9	.164055	269	9	.184407	256	9	.203848	245	9	.222456	235
1390	.143015	000	1460	.164353	000	1530	.184691	000	1600	.204120	000	1670	.222716	000
1	.143327	031	1	.164650	030	1	.184975	028	1	.204391	027	1	.222976	026
2	.143639	062	2	.164947	059	2	.185259	057	2	.204662	054	2	.223236	052
3	.143951	093	3	.165244	089	3	.185542	085	3	.204933	081	3	.223496	078
4	.144263	125	4	.165541	119	4	.185825	113	4	.205204	108	4	.223755	104
5	.144574	156	5	.165838	148	5	.186108	142	5	.205475	135	5	.224015	130
6	.144885	187	6	.166134	178	6	.186391	170	6	.205745	162	6	.224274	156
7	.145196	218	7	.166430	207	7	.186674	198	7	.206016	189	7	.224533	182
8	.145507	249	8	.166726	237	8	.186956	227	8	.206286	216	8	.224792	208
9	.145818	280	9	.167022	267	9	.187239	255	9	.206556	243	9	.225051	234
1400	.146128	000	1470	.167317	000	1540	.187521	000	1610	.206826	000	1680	.225309	000
1	.146438	031	1	.167613	029	1	.187803	028	1	.207095	027	1	.225568	026
2	.146748	062	2	.167908	059	2	.188084	056	2	.207365	054	2	.225826	052
3	.147058	093	3	.168203	088	3	.188366	084	3	.207634	081	3	.226084	077
4	.147367	124	4	.168497	118	4	.188647	113	4	.207903	108	4	.226342	103
5	.147676	155	5	.168792	147	5	.188928	141	5	.208172	135	5	.226600	129
6	.147985	186	6	.169086	177	6	.189209	169	6	.208441	162	6	.226858	155
7	.148294	217	7	.169380	206	7	.189490	197	7	.208710	188	7	.227115	181
8	.148603	248	8	.169674	236	8	.189771	225	8	.208978	215	8	.227372	206
9	.148911	279	9	.169968	265	9	.190051	253	9	.209247	241	9	.227630	232
1410	.149219	000	1480	.170262	000	1550	.190332	000	1620	.209515	000	1690	.227887	000
1	.149527	031	1	.170555	029	1	.190612	028	1	.209783	027	1	.228144	026
2	.149835	061	2	.170848	058	2	.190892	056	2	.210051	054	2	.228400	051
3	.150142	092	3	.171141	088	3	.191171	084	3	.210318	080	3	.228657	077
4	.150449	123	4	.171434	117	4	.191451	112	4	.210586	107	4	.228913	102
5	.150756	154	5	.171726	146	5	.191730	140	5	.210853	134	5	.229170	128
6	.151063	184	6	.172019	175	6	.192010	168	6	.211120	161	6	.229426	154
7	.151370	215	7	.172311	204	7	.192289	196	7	.211388	187	7	.229682	179
8	.151676	246	8	.172603	234	8	.192567	224	8	.211654	214	8	.229938	205
9	.151982	277	9	.172895	263	9	.192846	252	9	.211921	240	9	.230193	231

I log. .230449 to .311542

No. 1700 to 2049.

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No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
1700	.230449	000	1770	.247973	000	1840	.264818	000	1910	.281033	000	1980	.296665	000
1	.230704	025	1	.248219	025	1	.265054	023	1	.281261	023	1	.296884	022
2	.230960	051	2	.248464	049	2	.265290	047	2	.281488	045	2	.297104	044
3	.231215	076	3	.248709	074	3	.265525	070	3	.281715	068	3	.297323	066
4	.231470	102	4	.248954	098	4	.265761	094	4	.281942	091	4	.297542	088
5	.231724	127	5	.249198	123	5	.265996	117	5	.282169	113	5	.297760	109
6	.231979	153	6	.249443	147	6	.266232	141	6	.282395	136	6	.297979	131
7	.232233	178	7	.249687	172	7	.266467	164	7	.282622	159	7	.298198	153
8	.232486	204	8	.249932	196	8	.266702	188	8	.282849	181	8	.298416	175
9	.232742	229	9	.250176	220	9	.266937	211	9	.283075	204	9	.298635	197
1710	.232996	000	1780	.250420	000	1850	.267172	000	1920	.283301	000	1990	.298853	000
1	.233250	025	1	.250664	024	1	.267406	023	1	.283527	023	1	.299071	022
2	.233504	051	2	.250908	049	2	.267641	047	2	.283753	045	2	.299289	044
3	.233757	076	3	.251151	073	3	.267875	070	3	.283979	068	3	.299507	065
4	.234011	101	4	.251395	097	4	.268110	094	4	.284205	090	4	.299725	087
5	.234264	127	5	.251638	121	5	.268344	117	5	.284431	113	5	.299943	109
6	.234517	152	6	.251881	146	6	.268578	141	6	.284656	135	6	.300160	131
7	.234770	177	7	.252125	171	7	.268812	164	7	.284882	158	7	.300378	153
8	.235023	202	8	.252367	195	8	.269046	188	8	.285107	180	8	.300595	174
9	.235276	228	9	.252610	219	9	.269279	211	9	.285332	203	9	.300813	196
1720	.235528	000	1790	.252853	000	1860	.269513	000	1930	.285557	000	2000	.301030	000
1	.235781	025	1	.253096	024	1	.269746	023	1	.285782	022	1	.301247	022
2	.236033	050	2	.253338	048	2	.269980	047	2	.286007	045	2	.301464	043
3	.236285	076	3	.253580	073	3	.270213	070	3	.286232	067	3	.301681	065
4	.236537	101	4	.253822	097	4	.270446	093	4	.286456	089	4	.301898	087
5	.236789	126	5	.254064	121	5	.270679	116	5	.286681	112	5	.302114	108
6	.237041	151	6	.254306	145	6	.270912	140	6	.286905	134	6	.302331	130
7	.237292	176	7	.254548	170	7	.271144	163	7	.287130	157	7	.302547	152
8	.237544	202	8	.254790	194	8	.271377	186	8	.287354	179	8	.302764	173
9	.237795	227	9	.255031	218	9	.271609	210	9	.287578	202	9	.302980	195
1730	.238046	000	1800	.255272	000	1870	.271842	000	1940	.287802	000	2010	.303196	000
1	.238297	025	1	.255514	024	1	.272074	023	1	.288025	022	1	.303412	022
2	.238548	050	2	.255755	048	2	.272306	046	2	.288249	045	2	.303628	043
3	.238799	075	3	.255996	072	3	.272538	070	3	.288473	067	3	.303844	065
4	.239049	100	4	.256236	096	4	.272770	093	4	.288696	089	4	.304059	086
5	.239299	125	5	.256477	120	5	.273001	116	5	.288920	112	5	.304275	108
6	.239550	150	6	.256718	144	6	.273233	139	6	.289143	134	6	.304490	129
7	.239800	175	7	.256958	168	7	.273464	162	7	.289366	156	7	.304706	151
8	.240050	200	8	.257198	192	8	.273696	186	8	.289589	178	8	.304921	172
9	.240300	225	9	.257439	216	9	.273927	209	9	.289812	201	9	.305136	194
1740	.240549	000	1810	.257679	000	1880	.274158	000	1950	.290035	000	2020	.305351	000
1	.240799	025	1	.257918	024	1	.274389	023	1	.290257	022	1	.305566	021
2	.241048	050	2	.258158	048	2	.274620	046	2	.290480	044	2	.305781	043
3	.241297	075	3	.258398	072	3	.274850	069	3	.290702	067	3	.305996	064
4	.241546	100	4	.258637	096	4	.275081	092	4	.290925	089	4	.306210	086
5	.241795	124	5	.258877	120	5	.275311	115	5	.291147	111	5	.306425	107
6	.242044	149	6	.259116	144	6	.275542	138	6	.291369	133	6	.306639	129
7	.242293	174	7	.259355	167	7	.275772	161	7	.291591	156	7	.306854	150
8	.242541	199	8	.259594	192	8	.276002	184	8	.291813	178	8	.307068	172
9	.242790	223	9	.259833	215	9	.276232	207	9	.292034	200	9	.307282	193
1750	.243038	000	1820	.260071	000	1890	.276462	000	1960	.292256	000	2030	.307496	000
1	.243286	025	1	.260310	024	1	.276691	023	1	.292478	022	1	.307710	021
2	.243534	050	2	.260548	048	2	.276921	046	2	.292699	044	2	.307924	043
3	.243782	074	3	.260787	071	3	.277151	069	3	.292920	066	3	.308137	064
4	.244030	099	4	.261025	095	4	.277380	092	4	.293141	088	4	.308351	085
5	.244277	124	5	.261263	119	5	.277609	115	5	.293363	110	5	.308564	107
6	.244524	149	6	.261501	143	6	.277838	138	6	.293583	133	6	.308778	128
7	.244772	174	7	.261738	167	7	.278067	161	7	.293804	155	7	.308991	149
8	.245019	198	8	.261976	191	8	.278296	183	8	.294025	177	8	.309204	171
9	.245266	222	9	.262214	214	9	.278525	206	9	.294246	199	9	.309417	192
1760	.245513	000	1830	.262451	000	1900	.278754	000	1970	.294466	000	2040	.309630	000
1	.245759	025	1	.262688	024	1	.278982	023	1	.294687	022	1	.309843	021
2	.246006	049	2	.262925	047	2	.279210	045	2	.294907	044	2	.310056	043
3	.246252	074	3	.263162	071	3	.279439	068	3	.295127	066	3	.310268	064
4	.246499	098	4	.263399	095	4	.279667	091	4	.295347	088	4	.310481	085
5	.246745	123	5	.263636	118	5	.279895	114	5	.295567	110	5	.310693	126
6	.246991	148	6	.263873	142	6	.280123	137	6	.295787	132	6	.310906	127
7	.247236	173	7	.264109	166	7	.280351	160	7	.296007	154	7	.311118	148
8	.247482	197	8	.264345	190	8	.280578	182	8	.296226	176	8	.311330	170
9	.247728	221	9	.264582	213	9	.280806	205	9	.296446	198	9	.311542	191

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Log. .311754 to .380030

No. 2050 to 2399.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
2050	.311754	000	2120	.326336	000	2190	.340444	000	2260	.354108	000	2330	.367356	000
1	.311966	021	1	.326541	020	1	.340642	020	1	.354301	019	1	.367542	019
2	.312177	042	2	.326745	041	2	.340840	040	2	.354493	038	2	.367728	037
3	.312389	063	3	.326950	061	3	.341039	059	3	.354685	058	3	.367915	056
4	.312600	084	4	.327154	082	4	.341237	079	4	.354876	077	4	.368101	075
5	.312812	106	5	.327359	102	5	.341434	099	5	.355068	096	5	.368287	093
6	.313023	127	6	.327563	123	6	.341632	119	6	.355260	115	6	.368473	112
7	.313234	148	7	.327767	143	7	.341830	139	7	.355451	134	7	.368659	130
8	.313445	169	8	.327972	164	8	.342028	158	8	.355643	154	8	.368844	149
9	.313656	190	9	.328176	184	9	.342225	178	9	.355834	173	9	.369030	167
2060	.313867	000	2130	.328380	000	2200	.342423	000	2270	.356026	000	2340	.369216	000
1	.314078	021	1	.328583	020	1	.342620	020	1	.356217	019	1	.369401	019
2	.314289	042	2	.328787	041	2	.342817	039	2	.356408	038	2	.369587	037
3	.314499	063	3	.328991	061	3	.343014	059	3	.356599	057	3	.369772	056
4	.314710	084	4	.329194	081	4	.343212	079	4	.356790	076	4	.369958	074
5	.314920	105	5	.329398	102	5	.343409	099	5	.356981	095	5	.370143	093
6	.315130	126	6	.329601	122	6	.343605	118	6	.357172	115	6	.370328	111
7	.315340	147	7	.329804	142	7	.343802	138	7	.357363	134	7	.370513	130
8	.315550	168	8	.330008	163	8	.343999	158	8	.357554	153	8	.370698	148
9	.315760	189	9	.330211	183	9	.344196	178	9	.357744	172	9	.370883	167
2070	.315970	000	2140	.330414	000	2210	.344392	000	2280	.357935	000	2350	.371068	000
1	.316180	021	1	.330617	020	1	.344589	020	1	.358125	019	1	.371253	018
2	.316390	042	2	.330819	040	2	.344785	039	2	.358316	038	2	.371437	037
3	.316599	063	3	.331022	061	3	.344981	059	3	.358506	057	3	.371622	055
4	.316809	084	4	.331225	081	4	.345178	078	4	.358696	076	4	.371806	074
5	.317018	105	5	.331427	101	5	.345374	098	5	.358886	095	5	.371991	092
6	.317227	126	6	.331630	121	6	.345570	118	6	.359076	114	6	.372175	111
7	.317436	147	7	.331832	141	7	.345766	137	7	.359266	133	7	.372360	129
8	.317645	168	8	.332034	162	8	.345962	157	8	.359456	152	8	.372544	148
9	.317854	189	9	.332236	182	9	.346157	176	9	.359646	171	9	.372728	166
2080	.318063	000	2150	.332438	000	2220	.346353	000	2290	.359835	000	2360	.372912	000
1	.318272	021	1	.332640	020	1	.346549	019	1	.360025	019	1	.373096	018
2	.318481	042	2	.332842	040	2	.346744	039	2	.360215	038	2	.373280	037
3	.318689	063	3	.333044	060	3	.346939	058	3	.360404	057	3	.373464	055
4	.318898	083	4	.333246	081	4	.347135	078	4	.360593	076	4	.373647	074
5	.319106	104	5	.333447	101	5	.347330	097	5	.360783	095	5	.373831	092
6	.319314	125	6	.333649	121	6	.347525	117	6	.360972	114	6	.374015	110
7	.319522	146	7	.333850	141	7	.347720	137	7	.361161	133	7	.374198	129
8	.319730	167	8	.334051	161	8	.347915	156	8	.361350	152	8	.374382	147
9	.319938	188	9	.334253	181	9	.348110	175	9	.361539	171	9	.374565	166
2090	.320146	000	2160	.334454	000	2230	.348305	000	2300	.361728	000	2370	.374748	000
1	.320354	021	1	.334655	020	1	.348500	019	1	.361917	019	1	.374932	018
2	.320562	041	2	.334856	040	2	.348694	039	2	.362105	038	2	.375115	037
3	.320769	062	3	.335056	060	3	.348889	058	3	.362294	056	3	.375298	055
4	.320977	083	4	.335257	080	4	.349083	078	4	.362482	075	4	.375481	073
5	.321184	104	5	.335458	100	5	.349277	097	5	.362671	094	5	.375664	092
6	.321391	125	6	.335658	120	6	.349472	117	6	.362859	113	6	.375846	110
7	.321598	145	7	.335859	140	7	.349666	137	7	.363048	132	7	.376029	128
8	.321805	166	8	.336059	160	8	.349860	156	8	.363236	151	8	.376212	147
9	.322012	187	9	.336260	180	9	.350054	175	9	.363424	170	9	.376394	165
2100	.322219	000	2170	.336460	000	2240	.350248	000	2310	.363612	000	2380	.376577	000
1	.322426	021	1	.336660	020	1	.350442	019	1	.363800	019	1	.376759	018
2	.322633	041	2	.336860	040	2	.350636	039	2	.363988	037	2	.376942	036
3	.322839	062	3	.337060	060	3	.350829	058	3	.364176	056	3	.377124	055
4	.323046	082	4	.337259	080	4	.351023	077	4	.364363	075	4	.377306	073
5	.323252	103	5	.337459	100	5	.351216	097	5	.364551	094	5	.377488	091
6	.323458	124	6	.337659	120	6	.351410	116	6	.364739	112	6	.377670	109
7	.323664	144	7	.337858	140	7	.351603	135	7	.364926	131	7	.377852	127
8	.323871	165	8	.338058	160	8	.351796	155	8	.365113	150	8	.378034	146
9	.324077	186	9	.338257	180	9	.351989	174	9	.365301	169	9	.378216	164
2110	.324282	000	2180	.338456	000	2250	.352182	000	2320	.365488	000	2390	.378398	000
1	.324488	021	1	.338656	020	1	.352375	019	1	.365675	019	1	.378580	018
2	.324694	041	2	.338855	040	2	.352568	038	2	.365862	037	2	.378761	036
3	.324899	062	3	.339054	060	3	.352761	058	3	.366049	056	3	.378943	055
4	.325105	082	4	.339253	080	4	.352954	077	4	.366236	075	4	.379124	073
5	.325310	103	5	.339451	100	5	.353146	096	5	.366423	093	5	.379305	091
6	.325516	123	6	.339650	119	6	.353339	115	6	.366610	112	6	.379487	109
7	.325721	144	7	.339849	139	7	.353532	134	7	.366796	131	7	.379668	127
8	.325926	164	8	.340047	159	8	.353724	154	8	.366983	150	8	.379849	146
9	.326131	185	9	.340246	179	9	.353916	173	9	.367169	168	9	.380030	164

(u.)

Log. .380211 to .439175

No. 2400 to 2749.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
2400	.380211	000	2470	.392697	000	2540	.404834	000	2610	.416640	000	2680	.428135	000
1	.380392	018	1	.392873	018	1	.405005	017	1	.416807	017	1	.428297	016
2	.380573	036	2	.393048	035	2	.405175	034	2	.416973	033	2	.428459	032
3	.380754	055	3	.393224	053	3	.405346	051	3	.417139	050	3	.428621	048
4	.380934	073	4	.393400	070	4	.405517	068	4	.417306	066	4	.428782	065
5	.381115	091	5	.393575	088	5	.405688	085	5	.417472	083	5	.428944	081
6	.381296	109	6	.393751	106	6	.405858	102	6	.417638	100	6	.429106	097
7	.381476	127	7	.393926	123	7	.406029	119	7	.417804	116	7	.429268	113
8	.381656	145	8	.394101	141	8	.406199	136	8	.417970	133	8	.429429	129
9	.381837	163	9	.394276	158	9	.406370	153	9	.418135	149	9	.429591	145
2410	.382017	000	2480	.394452	000	2550	.406540	000	2620	.418301	000	2690	.429752	000
1	.382197	018	1	.394627	017	1	.406710	017	1	.418467	017	1	.429914	016
2	.382377	036	2	.394802	035	2	.406881	034	2	.418633	033	2	.430075	032
3	.382557	054	3	.394977	053	3	.407051	051	3	.418798	050	3	.430236	048
4	.382737	072	4	.395152	070	4	.407221	068	4	.418964	066	4	.430398	065
5	.382917	090	5	.395326	087	5	.407391	085	5	.419129	083	5	.430559	081
6	.383097	108	6	.395501	104	6	.407561	102	6	.419295	099	6	.430720	097
7	.383277	126	7	.395676	122	7	.407731	119	7	.419460	116	7	.430881	113
8	.383456	144	8	.395850	139	8	.407900	136	8	.419625	132	8	.431042	129
9	.383636	162	9	.396025	157	9	.408070	153	9	.419791	149	9	.431203	145
2420	.383815	000	2490	.396199	000	2560	.408240	000	2630	.419956	000	2700	.431364	000
1	.383995	018	1	.396374	017	1	.408410	017	1	.420121	016	1	.431525	016
2	.384174	036	2	.396548	035	2	.408579	034	2	.420286	033	2	.431685	032
3	.384353	054	3	.396722	053	3	.408749	051	3	.420451	049	3	.431846	048
4	.384533	072	4	.396896	070	4	.408918	068	4	.420616	066	4	.432007	064
5	.384712	090	5	.397070	087	5	.409087	085	5	.420781	082	5	.432167	080
6	.384891	108	6	.397245	104	6	.409257	102	6	.420945	099	6	.432328	096
7	.385070	126	7	.397418	122	7	.409426	119	7	.421110	115	7	.432488	112
8	.385249	144	8	.397592	139	8	.409595	136	8	.421275	132	8	.432649	128
9	.385427	162	9	.397766	157	9	.409764	153	9	.421439	148	9	.432809	144
2430	.385606	000	2500	.397940	000	2570	.409933	000	2640	.421604	000	2710	.432969	000
1	.385785	018	1	.398114	017	1	.410102	017	1	.421768	016	1	.433129	016
2	.385964	035	2	.398287	035	2	.410271	034	2	.421933	033	2	.433290	032
3	.386142	053	3	.398461	053	3	.410440	050	3	.422097	049	3	.433450	048
4	.386321	071	4	.398634	069	4	.410608	067	4	.422261	066	4	.433610	064
5	.386499	089	5	.398808	087	5	.410777	084	5	.422426	082	5	.433770	080
6	.386677	107	6	.398981	104	6	.410946	101	6	.422590	099	6	.433930	096
7	.386855	125	7	.399154	121	7	.411114	118	7	.422754	115	7	.434090	112
8	.387034	143	8	.399327	138	8	.411283	135	8	.422918	132	8	.434249	128
9	.387212	161	9	.399501	156	9	.411451	152	9	.423082	148	9	.434409	144
2440	.387390	000	2510	.399674	000	2580	.411620	000	2650	.423246	000	2720	.434569	000
1	.387568	018	1	.399847	017	1	.411788	017	1	.423410	016	1	.434728	016
2	.387746	036	2	.400020	035	2	.411956	034	2	.423573	033	2	.434888	032
3	.387923	053	3	.400192	053	3	.412124	050	3	.423737	049	3	.435048	048
4	.388101	071	4	.400365	069	4	.412292	067	4	.423901	065	4	.435207	064
5	.388279	089	5	.400538	087	5	.412460	064	5	.424064	061	5	.435366	060
6	.388456	107	6	.400711	104	6	.412628	101	6	.424228	098	6	.435526	056
7	.388634	125	7	.400883	121	7	.412796	118	7	.424392	114	7	.435685	112
8	.388811	142	8	.401056	138	8	.412964	135	8	.424555	131	8	.435844	128
9	.388989	160	9	.401228	156	9	.413132	152	9	.424718	147	9	.436003	144
2450	.389166	000	2520	.401400	000	2590	.413300	000	2660	.424882	000	2730	.436163	000
1	.389343	018	1	.401573	017	1	.413467	017	1	.425045	016	1	.436322	016
2	.389520	036	2	.401745	034	2	.413635	033	2	.425208	033	2	.436481	032
3	.389697	053	3	.401917	052	3	.413802	050	3	.425371	049	3	.436640	047
4	.389875	071	4	.402089	069	4	.413970	067	4	.425534	065	4	.436798	063
5	.390051	089	5	.402261	086	5	.414137	064	5	.425697	061	5	.436957	079
6	.390228	107	6	.402433	103	6	.414305	101	6	.425860	098	6	.437116	095
7	.390405	125	7	.402605	120	7	.414472	117	7	.426023	114	7	.437275	111
8	.390582	142	8	.402777	138	8	.414639	134	8	.426186	130	8	.437433	127
9	.390758	160	9	.402949	155	9	.414806	151	9	.426349	147	9	.437592	143
2460	.390935	000	2530	.403120	000	2600	.414973	000	2670	.426511	000	2740	.437751	000
1	.391112	018	1	.403292	017	1	.415140	017	1	.426674	016	1	.437909	016
2	.391283	035	2	.403464	034	2	.415307	033	2	.426836	033	2	.438067	032
3	.391464	053	3	.403635	052	3	.415474	050	3	.426999	049	3	.438226	047
4	.391641	070	4	.403807	069	4	.415641	067	4	.427161	065	4	.438384	063
5	.391817	088	5	.403978	086	5	.415808	084	5	.427324	081	5	.438542	079
6	.391993	106	6	.404149	103	6	.415974	101	6	.427486	098	6	.438700	095
7	.392169	123	7	.404320	120	7	.416141	117	7	.427648	114	7	.438859	111
8	.392345	141	8	.404492	137	8	.416308	134	8	.427811	130	8	.439017	127
9	.392521	158	9	.404663	154	9	.416474	150	9	.427973	147	9	.439175	143

(u.)

Log. .439333 to .491222

No. 275C *o 3099.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
2750	.439333	000	2820	.450249	000	2890	.460898	000	2960	.471292	000	3030	.481443	000			
1	.439491	016	1	.450403	015	1	.461048	015	1	.471438	015	1	.481586	014			
2	.439648	032	2	.450557	031	2	.461198	030	2	.471585	029	2	.481729	029			
3	.439806	047	3	.450711	046	3	.461348	045	3	.471732	044	3	.481872	043			
4	.439964	063	4	.450865	062	4	.461498	060	4	.471878	059	4	.482016	057			
5	.440122	079	5	.451018	077	5	.461649	075	5	.472025	073	5	.482159	071			
6	.440279	095	6	.451172	092	6	.461799	090	6	.472171	088	6	.482302	086			
7	.440437	111	7	.451326	108	7	.461948	105	7	.472317	102	7	.482445	100			
8	.440594	126	8	.451479	123	8	.462098	120	8	.472464	117	8	.482588	114			
9	.440752	142	9	.451633	139	9	.462248	135	9	.472610	132	9	.482731	129			
2760	.440909	000	2830	.451786	000	2900	.462398	000	2970	.472756	000	3040	.482874	000			
1	.441066	016	1	.451940	015	1	.462548	015	1	.472903	015	1	.483016	014			
2	.441224	031	2	.452093	031	2	.462697	030	2	.473049	029	2	.483159	028			
3	.441381	047	3	.452247	046	3	.462847	045	3	.473195	044	3	.483302	043			
4	.441538	063	4	.452400	061	4	.462997	060	4	.473341	059	4	.483445	057			
5	.441695	078	5	.452553	077	5	.463146	075	5	.473487	073	5	.483587	071			
6	.441852	094	6	.452706	092	6	.463296	090	6	.473633	088	6	.483730	085			
7	.442009	110	7	.452859	107	7	.463445	105	7	.473779	102	7	.483872	099			
8	.442166	126	8	.453012	123	8	.463594	120	8	.473925	117	8	.484015	114			
9	.442323	141	9	.453165	138	9	.463744	135	9	.474070	132	9	.484157	128			
2770	.442480	000	2840	.453318	000	2910	.463893	000	2980	.474216	000	3050	.484300	000			
1	.442636	016	1	.453471	015	1	.464042	015	1	.474362	015	1	.484442	014			
2	.442793	031	2	.453624	031	2	.464191	030	2	.474508	029	2	.484584	028			
3	.442950	047	3	.453777	046	3	.464340	045	3	.474653	044	3	.484727	043			
4	.443106	063	4	.453930	061	4	.464489	060	4	.474799	058	4	.484869	057			
5	.443263	078	5	.454082	077	5	.464639	075	5	.474944	073	5	.485011	071			
6	.443419	094	6	.454235	092	6	.464787	090	6	.475090	088	6	.485153	085			
7	.443576	110	7	.454387	107	7	.464936	105	7	.475235	102	7	.485295	099			
8	.443732	126	8	.454540	123	8	.465085	120	8	.475381	117	8	.485437	114			
9	.443888	141	9	.454692	138	9	.465234	135	9	.475526	131	9	.485579	128			
2780	.444045	000	2850	.454845	000	2920	.465383	000	2990	.475671	000	3060	.485721	000			
1	.444201	016	1	.454997	015	1	.465532	015	1	.475816	015	1	.485863	014			
2	.444357	031	2	.455149	030	2	.465680	030	2	.475962	029	2	.486005	028			
3	.444513	047	3	.455302	046	3	.465829	044	3	.476107	043	3	.486147	043			
4	.444669	062	4	.455454	061	4	.465977	059	4	.476252	058	4	.486289	057			
5	.444825	078	5	.455606	076	5	.466126	074	5	.476397	072	5	.486430	071			
6	.444981	094	6	.455758	091	6	.466274	089	6	.476542	087	6	.486572	085			
7	.445137	109	7	.455910	106	7	.466423	104	7	.476687	101	7	.486714	099			
8	.445293	125	8	.456062	122	8	.466571	118	8	.476832	116	8	.486855	114			
9	.445448	140	9	.456214	137	9	.466719	133	9	.476976	130	9	.486997	128			
2790	.445604	000	2860	.456366	000	2930	.466868	000	3000	.477121	000	3070	.487138	000			
1	.445760	016	1	.456518	015	1	.467016	015	1	.477266	014	1	.487280	014			
2	.445915	031	2	.456670	030	2	.467164	030	2	.477411	029	2	.487421	028			
3	.446071	047	3	.456821	046	3	.467312	044	3	.477555	043	3	.487563	042			
4	.446226	062	4	.456973	061	4	.467460	059	4	.477700	058	4	.487704	057			
5	.446382	078	5	.457125	076	5	.467608	074	5	.477844	072	5	.487845	071			
6	.446537	094	6	.457276	091	6	.467756	089	6	.477989	087	6	.487986	085			
7	.446692	109	7	.457428	106	7	.467904	104	7	.478133	101	7	.488127	099			
8	.446848	125	8	.457579	122	8	.468052	118	8	.478278	116	8	.488269	113			
9	.447003	140	9	.457730	137	9	.468200	133	9	.478422	130	9	.488410	127			
2800	.447158	000	2870	.457882	000	2940	.468347	000	3010	.478566	000	3080	.488551	000			
1	.447313	015	1	.458033	015	1	.468495	015	1	.478711	014	1	.488692	014			
2	.447468	031	2	.458184	030	2	.468643	030	2	.478855	029	2	.488833	028			
3	.447623	046	3	.458336	045	3	.468790	044	3	.478999	043	3	.488973	042			
4	.447778	062	4	.458487	061	4	.468938	059	4	.479143	058	4	.489114	056			
5	.447933	077	5	.458638	076	5	.469085	074	5	.479287	072	5	.489255	070			
6	.448088	093	6	.458789	091	6	.469233	089	6	.479431	086	6	.489396	084			
7	.448242	108	7	.458940	106	7	.469380	104	7	.479575	101	7	.489537	098			
8	.448397	124	8	.459091	121	8	.469527	118	8	.479719	115	8	.489677	112			
9	.448552	139	9	.459242	136	9	.469675	133	9	.479863	130	9	.489818	126			
2810	.448706	000	2880	.459392	000	2950	.469822	000	3020	.480007	000	3090	.489958	000			
1	.448861	015	1	.459543	015	1	.469969	015	1	.480151	014	1	.490099	014			
2	.449015	031	2	.459694	030	2	.470116	029	2	.480294	029	2	.490239	028			
3	.449170	046	3	.459845	045	3	.470263	044	3	.480438	043	3	.490380	042			
4	.449324	062	4	.459995	061	4	.470410	059	4	.480582	058	4	.490520	056			
5	.449478	077	5	.460146	076	5	.470557	074	5	.480725	072	5	.490661	070			
6	.449633	092	6	.460296	091	6	.470704	088	6	.480869	086	6	.490801	084			
7	.449787	108	7	.460447	106	7	.470851	103	7	.481012	101	7	.490941	093			
8	.449941	123	8	.460597	121	8	.470998	118	8	.481156	115	8	.491081	112			
9	.450095	139	9	.460747	136	9	.471145	132	9	.481299	130	9	.491222	126			

(u.)

Log. .491362 to .537693

No. 3100 to 3149.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
3100 .491362	000		3170 .501059	000		3240 .510545	000		3310 .519828	000		3380 .528917	000	
1 .491502	014		1 .501196	014		1 .510679	013		1 .519959	013		1 .529045	013	
2 .491642	028		2 .501333	027		2 .510813	027		2 .520090	026		2 .529174	026	
3 .491782	042		3 .501470	041		3 .510947	040		3 .520221	039		3 .529302	038	
4 .491922	056		4 .501607	055		4 .511081	054		4 .520352	052		4 .529430	051	
5 .492062	070		5 .501744	068		5 .511215	067		5 .520483	066		5 .529559	064	
6 .492201	084		6 .501880	082		6 .511348	080		6 .520614	079		6 .529687	077	
7 .492341	098		7 .502017	096		7 .511482	094		7 .520745	092		7 .529815	090	
8 .492481	112		8 .502154	110		8 .511616	107		8 .520876	105		8 .529943	103	
9 .492621	126		9 .502290	123		9 .511750	121		9 .521007	118		9 .530072	116	
3110 .492760	000		3180 .502427	000		3250 .511883	000		3320 .521138	000		3390 .530200	000	
1 .492900	014		1 .502564	014		1 .512017	013		1 .521269	013		1 .530328	013	
2 .493040	028		2 .502700	027		2 .512150	027		2 .521400	026		2 .530456	026	
3 .493179	042		3 .502837	041		3 .512284	040		3 .521530	039		3 .530584	038	
4 .493319	056		4 .502973	054		4 .512417	053		4 .521661	052		4 .530712	051	
5 .493458	070		5 .503109	068		5 .512551	067		5 .521792	065		5 .530840	064	
6 .493597	084		6 .503246	082		6 .512684	080		6 .521922	078		6 .530968	077	
7 .493737	098		7 .503382	095		7 .512818	093		7 .522053	097		7 .531095	090	
8 .493876	112		8 .503518	109		8 .512951	107		8 .522183	104		8 .531223	102	
9 .494015	126		9 .503654	123		9 .513084	120		9 .522314	117		9 .531351	115	
3120 .494155	000		3190 .503791	000		3260 .513218	000		3330 .522444	000		3400 .531479	000	
1 .494294	014		1 .503927	014		1 .513351	013		1 .522575	013		1 .531607	013	
2 .494433	028		2 .504063	027		2 .513484	027		2 .522705	026		2 .531734	025	
3 .494572	041		3 .504199	041		3 .513617	040		3 .522835	039		3 .531862	038	
4 .494711	056		4 .504335	054		4 .513750	053		4 .522966	052		4 .531990	051	
5 .494850	069		5 .504471	068		5 .513883	066		5 .523096	065		5 .532117	063	
6 .494989	083		6 .504607	082		6 .514016	080		6 .523226	078		6 .532245	076	
7 .495128	097		7 .504743	095		7 .514149	093		7 .523356	097		7 .532372	089	
8 .495267	111		8 .504878	109		8 .514282	106		8 .523486	104		8 .532500	102	
9 .495406	125		9 .505014	122		9 .514415	120		9 .523616	117		9 .532627	114	
3130 .495544	000		3200 .505150	000		3270 .514548	000		3340 .523746	000		3410 .532754	000	
1 .495683	014		1 .505286	014		1 .514680	013		1 .523876	013		1 .532882	013	
2 .495822	028		2 .505421	027		2 .514813	027		2 .524006	026		2 .533009	025	
3 .495960	041		3 .505557	041		3 .514946	040		3 .524136	039		3 .533136	038	
4 .496099	056		4 .505692	054		4 .515079	053		4 .524266	052		4 .533263	051	
5 .496237	069		5 .505828	068		5 .515211	066		5 .524396	065		5 .533391	063	
6 .496376	083		6 .505963	082		6 .515344	080		6 .524526	078		6 .533518	076	
7 .496514	097		7 .506099	095		7 .515476	093		7 .524656	091		7 .533645	089	
8 .496653	111		8 .506234	109		8 .515609	106		8 .524785	104		8 .533772	102	
9 .496791	125		9 .506370	122		9 .515741	120		9 .524915	117		9 .533899	114	
3140 .496930	000		3210 .506505	000		3280 .515874	000		3350 .525045	000		3420 .534026	000	
1 .497068	014		1 .506640	013		1 .516006	013		1 .525174	013		1 .534153	013	
2 .497206	028		2 .506775	027		2 .516139	026		2 .525304	026		2 .534280	025	
3 .497344	041		3 .506911	040		3 .516271	040		3 .525434	039		3 .534407	038	
4 .497482	055		4 .507046	054		4 .516403	053		4 .525563	052		4 .534534	051	
5 .497621	069		5 .507181	067		5 .516535	066		5 .525692	065		5 .534661	063	
6 .497759	083		6 .507316	081		6 .516668	079		6 .525822	078		6 .534787	076	
7 .497897	097		7 .507451	094		7 .516800	092		7 .525951	091		7 .534914	089	
8 .498035	110		8 .507586	108		8 .516932	106		8 .526081	104		8 .535041	102	
9 .498173	124		9 .507721	121		9 .517064	119		9 .526216	117		9 .535167	114	
3150 .498311	000		3220 .507856	000		3290 .517196	000		3360 .526339	000		3430 .535294	000	
1 .498448	014		1 .507991	013		1 .517328	013		1 .526468	013		1 .535421	013	
2 .498586	028		2 .508125	027		2 .517460	026		2 .526598	026		2 .535547	025	
3 .498724	041		3 .508260	040		3 .517592	040		3 .526727	039		3 .535674	038	
4 .498862	055		4 .508395	054		4 .517724	053		4 .526856	052		4 .535800	050	
5 .498999	069		5 .508530	067		5 .517855	066		5 .526985	065		5 .535927	063	
6 .499137	083		6 .508664	081		6 .517987	079		6 .527114	078		6 .536053	076	
7 .499275	097		7 .508799	094		7 .518119	092		7 .527243	091		7 .536179	088	
8 .499412	110		8 .508933	108		8 .518251	106		8 .527372	104		8 .536306	101	
9 .499550	124		9 .509068	121		9 .518382	119		9 .527501	117		9 .536432	114	
3160 .499687	000		3230 .509202	000		3300 .518514	000		3370 .527630	000		3440 .536558	000	
1 .499824	014		1 .509337	013		1 .518645	013		1 .527759	013		1 .536685	013	
2 .499962	027		2 .509471	027		2 .518777	026		2 .527888	026		2 .536811	025	
3 .500099	041		3 .509606	040		3 .518909	039		3 .528016	038		3 .536937	038	
4 .500236	055		4 .509740	054		4 .519040	052		4 .528145	051		4 .537063	050	
5 .500374	068		5 .509874	067		5 .519171	066		5 .528274	064		5 .537189	063	
6 .500511	082		6 .510008	081		6 .519303	079		6 .528402	077		6 .537315	076	
7 .500648	096		7 .510143	094		7 .519434	092		7 .528531	090		7 .537441	088	
8 .500785	110		8 .510277	108		8 .519565	105		8 .528660	103		8 .537567	101	
9 .500922	123		9 .510411	121		9 .519697	118		9 .528788	116		9 .537693	114	

(u.)

Log. .537819 to .579669

No. 3450 to 3799.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
3450	.537819	000	3520	.546543	000	3590	.555094	000	3660	.563481	000	3730	.571709	000
1	.537945	013	1	.546666	012	1	.555215	012	1	.563600	012	1	.571825	012
2	.538071	025	2	.546789	025	2	.555336	024	2	.563718	024	2	.571942	023
3	.538197	038	3	.546913	037	3	.555457	036	3	.563837	036	3	.572058	035
4	.538322	050	4	.547036	049	4	.555578	048	4	.563955	048	4	.572174	047
5	.538448	063	5	.547159	062	5	.555699	060	5	.564074	060	5	.572291	058
6	.538574	076	6	.547282	074	6	.555820	072	6	.564192	071	6	.572407	070
7	.538699	088	7	.547405	086	7	.555940	084	7	.564311	083	7	.572523	081
8	.538825	101	8	.547529	099	8	.556061	096	8	.564429	095	8	.572639	093
9	.538951	114	9	.547652	111	9	.556182	108	9	.564548	107	9	.572755	105
3460	.539076	000	3530	.547775	000	3600	.556302	000	3670	.564666	000	3740	.572872	000
1	.539202	013	1	.547898	012	1	.556423	012	1	.564784	012	1	.572988	012
2	.539327	025	2	.548021	025	2	.556544	024	2	.564903	024	2	.573104	023
3	.539452	038	3	.548144	037	3	.556664	036	3	.565021	036	3	.573220	035
4	.539578	050	4	.548266	049	4	.556785	048	4	.565139	047	4	.573336	046
5	.539703	063	5	.548389	061	5	.556905	060	5	.565257	059	5	.573452	058
6	.539829	075	6	.548512	074	6	.557026	072	6	.565375	071	6	.573568	070
7	.539954	088	7	.548635	086	7	.557146	084	7	.565494	083	7	.573684	081
8	.540079	100	8	.548758	098	8	.557266	096	8	.565612	095	8	.573800	093
9	.540204	113	9	.548881	111	9	.557387	108	9	.565730	107	9	.573915	104
3470	.540329	000	3540	.549003	000	3610	.557507	000	3680	.565848	000	3750	.574031	000
1	.540455	012	1	.549126	012	1	.557627	012	1	.565966	012	1	.574147	012
2	.540580	025	2	.549249	025	2	.557748	024	2	.566084	024	2	.574263	023
3	.540705	037	3	.549371	037	3	.557868	036	3	.566202	035	3	.574379	035
4	.540830	050	4	.549494	049	4	.557988	048	4	.566320	047	4	.574494	046
5	.540955	062	5	.549616	061	5	.558108	060	5	.566437	059	5	.574610	058
6	.541080	075	6	.549739	074	6	.558228	072	6	.566555	071	6	.574726	070
7	.541205	087	7	.549861	086	7	.558348	084	7	.566673	083	7	.574841	081
8	.541330	100	8	.549984	098	8	.558469	096	8	.566791	094	8	.574957	093
9	.541454	112	9	.550106	111	9	.558589	108	9	.566909	106	9	.575072	104
3480	.541579	000	3550	.550228	000	3620	.558709	000	3690	.567026	000	3760	.575188	000
1	.541704	012	1	.550351	012	1	.558828	012	1	.567144	012	1	.575303	012
2	.541829	025	2	.550473	024	2	.558948	024	2	.567262	024	2	.575419	023
3	.541953	037	3	.550595	037	3	.559068	036	3	.567379	035	3	.575534	035
4	.542078	050	4	.550717	049	4	.559188	048	4	.567497	047	4	.575650	046
5	.542203	062	5	.550840	061	5	.559308	060	5	.567614	059	5	.575765	058
6	.542327	075	6	.550962	073	6	.559428	072	6	.567732	071	6	.575880	069
7	.542452	087	7	.551084	086	7	.559548	084	7	.567849	083	7	.575996	080
8	.542576	100	8	.551206	098	8	.559667	096	8	.567967	094	8	.576111	092
9	.542701	112	9	.551328	110	9	.559787	108	9	.568084	106	9	.576226	104
3490	.542825	000	3560	.551450	000	3630	.559907	000	3700	.568202	000	3770	.576341	000
1	.542950	012	1	.551572	012	1	.560026	012	1	.568319	012	1	.576456	012
2	.543074	025	2	.551694	024	2	.560146	024	2	.568436	023	2	.576572	023
3	.543199	037	3	.551816	037	3	.560265	036	3	.568554	035	3	.576687	035
4	.543323	050	4	.551938	049	4	.560385	048	4	.568671	047	4	.576802	046
5	.543447	062	5	.552059	061	5	.560504	060	5	.568788	058	5	.576917	058
6	.543571	075	6	.552181	073	6	.560624	072	6	.568905	070	6	.577032	069
7	.543696	087	7	.552303	086	7	.560743	084	7	.569023	082	7	.577147	080
8	.543820	100	8	.552425	098	8	.560863	096	8	.569140	094	8	.577262	092
9	.543944	112	9	.552546	110	9	.560982	108	9	.569257	106	9	.577377	104
3500	.544068	000	3570	.552668	000	3640	.561101	000	3710	.569374	000	3780	.577492	000
1	.544192	012	1	.552790	012	1	.561221	012	1	.569491	012	1	.577607	011
2	.544316	025	2	.552911	024	2	.561340	024	2	.569608	023	2	.577721	023
3	.544440	037	3	.553033	036	3	.561459	036	3	.569725	035	3	.577836	034
4	.544564	050	4	.553154	049	4	.561578	048	4	.569842	047	4	.577951	046
5	.544688	062	5	.553276	061	5	.561697	060	5	.569959	058	5	.578066	057
6	.544812	074	6	.553397	073	6	.561817	072	6	.570076	070	6	.578181	068
7	.544936	087	7	.553519	085	7	.561936	084	7	.570193	082	7	.578295	080
8	.545060	099	8	.553640	097	8	.562055	096	8	.570309	094	8	.578410	091
9	.545183	112	9	.553762	109	9	.562174	108	9	.570426	106	9	.578525	103
3510	.545307	000	3580	.553883	000	3650	.562293	000	3720	.570543	000	3790	.578639	000
1	.545431	012	1	.554004	012	1	.562412	012	1	.570660	012	1	.578754	011
2	.545554	025	2	.554126	024	2	.562531	024	2	.570776	023	2	.578868	023
3	.545678	037	3	.554247	036	3	.562650	036	3	.570893	035	3	.578983	034
4	.545802	049	4	.554368	049	4	.562768	048	4	.571010	047	4	.579097	046
5	.545925	062	5	.554489	061	5	.562887	060	5	.571126	058	5	.579212	057
6	.546049	074	6	.554610	073	6	.563006	071	6	.571243	070	6	.579326	068
7	.546172	086	7	.554731	085	7	.563125	083	7	.571359	081	7	.579441	080
8	.546296	099	8	.554852	097	8	.563244	095	8	.571476	093	8	.579555	091
9	.546419	111	9	.554973	109	9	.563362	107	9	.571592	105	9	.579669	103

(u.)

Log. .579784 to .617943

No. 3800 to 4149.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
3800	.579784	000	3870	.587711	000	3940	.595496	000	4010	.603144	000	4080	.610660	000
1	.579898	011	1	.587823	011	1	.595606	011	1	.603253	011	1	.610767	011
2	.580012	023	2	.587935	022	2	.595717	022	2	.603361	022	2	.610873	021
3	.580126	034	3	.588047	034	3	.595827	033	3	.603469	033	3	.610979	032
4	.580240	046	4	.588160	045	4	.595937	044	4	.603577	043	4	.611086	042
5	.580355	057	5	.588272	056	5	.596047	055	5	.603685	054	5	.611192	053
6	.580469	068	6	.588384	067	6	.596157	066	6	.603794	065	6	.611298	064
7	.580583	080	7	.588496	078	7	.596267	077	7	.603902	076	7	.611405	074
8	.580697	091	8	.588608	090	8	.596377	088	8	.604010	087	8	.611511	085
9	.580811	103	9	.588720	101	9	.596487	099	9	.604118	098	9	.611617	095
3810	.580925	000	3880	.588832	000	3950	.596597	000	4020	.604226	000	4090	.611723	000
1	.581039	011	1	.588944	011	1	.596707	011	1	.604334	011	1	.611829	011
2	.581153	023	2	.589055	022	2	.596817	022	2	.604442	022	2	.611936	021
3	.581267	034	3	.589167	033	3	.596927	033	3	.604550	032	3	.612042	032
4	.581381	046	4	.589279	044	4	.597037	044	4	.604658	043	4	.612148	042
5	.581494	057	5	.589391	056	5	.597146	055	5	.604766	054	5	.612254	053
6	.581608	068	6	.589503	067	6	.597256	066	6	.604874	065	6	.612360	064
7	.581722	080	7	.589614	078	7	.597366	077	7	.604982	076	7	.612466	074
8	.581836	091	8	.589726	089	8	.597476	088	8	.605098	086	8	.612572	085
9	.581950	103	9	.589838	100	9	.597585	099	9	.605197	097	9	.612678	095
3820	.582063	000	3890	.589950	000	3960	.597695	000	4030	.605305	000	4100	.612784	000
1	.582177	011	1	.590061	011	1	.597805	011	1	.605413	011	1	.612890	011
2	.582291	023	2	.590173	022	2	.597914	022	2	.605520	022	2	.612996	021
3	.582404	034	3	.590284	033	3	.598024	033	3	.605628	032	3	.613101	032
4	.582518	045	4	.590396	044	4	.598134	044	4	.605736	043	4	.613207	042
5	.582631	056	5	.590507	056	5	.598243	055	5	.605843	054	5	.613313	053
6	.582745	068	6	.590619	067	6	.598353	066	6	.605951	065	6	.613419	064
7	.582858	079	7	.590730	078	7	.598462	077	7	.606059	076	7	.613525	074
8	.582972	090	8	.590842	089	8	.598572	088	8	.606166	086	8	.613630	085
9	.583085	102	9	.590953	100	9	.598681	099	9	.606274	097	9	.613736	095
3830	.583199	000	3900	.591065	000	3970	.598790	000	4040	.606381	000	4110	.613842	000
1	.583312	011	1	.591176	011	1	.598900	011	1	.606489	011	1	.613947	011
2	.583425	023	2	.591287	022	2	.599009	022	2	.606596	021	2	.614053	021
3	.583539	034	3	.591399	033	3	.599119	033	3	.606704	032	3	.614159	032
4	.583652	045	4	.591510	044	4	.599228	044	4	.606811	043	4	.614264	042
5	.583765	056	5	.591621	056	5	.599337	055	5	.606918	054	5	.614370	053
6	.583879	068	6	.591732	067	6	.599446	066	6	.607026	064	6	.614475	063
7	.583992	079	7	.591843	078	7	.599556	077	7	.607133	075	7	.614581	074
8	.584105	090	8	.591955	089	8	.599665	088	8	.607240	086	8	.614686	084
9	.584218	102	9	.592066	100	9	.599774	099	9	.607348	096	9	.614792	095
3840	.584331	000	3910	.592177	000	3980	.599883	000	4050	.607455	000	4120	.614897	000
1	.584444	011	1	.592288	011	1	.599992	011	1	.607562	011	1	.615003	011
2	.584557	023	2	.592399	022	2	.600101	022	2	.607669	021	2	.615108	021
3	.584670	034	3	.592510	033	3	.600210	033	3	.607777	032	3	.615213	031
4	.584783	045	4	.592621	044	4	.600319	044	4	.607884	043	4	.615319	042
5	.584896	056	5	.592732	055	5	.600428	054	5	.607991	054	5	.615424	052
6	.585009	068	6	.592843	067	6	.600537	065	6	.608098	064	6	.615529	063
7	.585122	079	7	.592954	078	7	.600646	076	7	.608205	075	7	.615634	073
8	.585235	090	8	.593064	089	8	.600755	087	8	.608312	086	8	.615740	084
9	.585348	102	9	.593175	100	9	.600864	098	9	.608419	096	9	.615845	095
3850	.585461	000	3920	.593286	000	3990	.600973	000	4060	.608526	000	4130	.615950	000
1	.585573	011	1	.593397	011	1	.601082	011	1	.608633	011	1	.616055	011
2	.585686	022	2	.593508	022	2	.601190	022	2	.608740	021	2	.616160	021
3	.585799	034	3	.593618	033	3	.601299	033	3	.608847	032	3	.616265	031
4	.585912	045	4	.593729	044	4	.601408	044	4	.608954	043	4	.616370	042
5	.586024	056	5	.593840	055	5	.601517	054	5	.609060	053	5	.616475	052
6	.586137	067	6	.593950	066	6	.601625	065	6	.609167	064	6	.616580	063
7	.586250	078	7	.594061	077	7	.601734	076	7	.609274	075	7	.616685	073
8	.586362	090	8	.594171	088	8	.601843	087	8	.609381	086	8	.616790	084
9	.586475	101	9	.594282	099	9	.601951	098	9	.609488	096	9	.616895	095
3860	.586587	000	3930	.594393	000	4000	.602060	000	4070	.609594	000	4140	.617000	000
1	.586700	011	1	.594503	011	1	.602169	011	1	.609701	011	1	.617105	010
2	.586812	022	2	.594613	022	2	.602277	022	2	.609808	021	2	.617210	021
3	.586925	034	3	.594724	033	3	.602386	033	3	.609914	032	3	.617315	031
4	.587037	045	4	.594834	044	4	.602494	043	4	.610021	043	4	.617420	042
5	.587149	056	5	.594945	055	5	.602602	054	5	.610128	053	5	.617524	052
6	.587262	067	6	.595055	066	6	.602711	065	6	.610234	064	6	.617629	063
7	.587374	078	7	.595165	077	7	.602819	076	7	.610341	075	7	.617734	073
8	.587486	090	8	.595276	088	8	.602928	087	8	.610447	086	8	.617839	084
9	.587599	101	9	.595386	099	9	.603036	098	9	.610554	096	9	.617943	094

(u.)

Log. .618048 to .653116

No. 4150 to 4499.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
4150 .618048	000		4220 .625312	000		4290 .632457	000		4360 .639488	000		4430 .646404	000	
1 .618153	010		1 .625415	010		1 .632558	010		1 .639586	010		1 .646502	010	
2 .618257	021		2 .625518	021		2 .632660	020		2 .639686	020		2 .646600	020	
3 .618362	031		3 .625621	031		3 .632761	030		3 .639785	030		3 .646698	029	
4 .618466	042		4 .625724	041		4 .632862	041		4 .639885	040		4 .646796	039	
5 .618571	052		5 .625827	051		5 .632963	051		5 .639984	050		5 .646894	049	
6 .618675	062		6 .625929	062		6 .633064	061		6 .640084	060		6 .646991	059	
7 .618780	073		7 .626032	072		7 .633165	071		7 .640183	070		7 .647089	069	
8 .618884	083		8 .626135	082		8 .633266	081		8 .640283	080		8 .647187	078	
9 .618989	094		9 .626238	093		9 .633367	091		9 .640382	090		9 .647285	088	
4160 .619093	000		4230 .626340	000		4300 .633468	000		4370 .640481	000		4440 .647383	000	
1 .619198	010		1 .626443	010		1 .633569	019		1 .640581	010		1 .647481	010	
2 .619302	021		2 .626546	021		2 .633670	020		2 .640680	020		2 .647579	020	
3 .619406	031		3 .626648	031		3 .633771	030		3 .640779	030		3 .647676	029	
4 .619511	042		4 .626751	041		4 .633872	040		4 .640879	040		4 .647774	039	
5 .619615	052		5 .626853	051		5 .633973	050		5 .640978	050		5 .647872	049	
6 .619719	062		6 .626956	062		6 .634074	061		6 .641077	060		6 .647969	059	
7 .619823	073		7 .627058	072		7 .634175	071		7 .641176	070		7 .648067	069	
8 .619928	083		8 .627161	082		8 .634276	081		8 .641276	080		8 .648165	078	
9 .620032	094		9 .627263	093		9 .634377	091		9 .641375	090		9 .648262	088	
4170 .620136	000		4240 .627366	000		4310 .634477	000		4380 .641474	000		4450 .648360	000	
1 .620240	010		1 .627468	010		1 .634578	010		1 .641573	010		1 .648458	010	
2 .620344	021		2 .627571	020		2 .634679	020		2 .641672	020		2 .648555	019	
3 .620448	031		3 .627673	031		3 .634779	030		3 .641771	030		3 .648653	029	
4 .620552	042		4 .627775	041		4 .634880	040		4 .641870	040		4 .648750	039	
5 .620656	052		5 .627878	051		5 .634981	050		5 .641970	050		5 .648848	049	
6 .620760	062		6 .627980	061		6 .635081	061		6 .642069	059		6 .648945	058	
7 .620864	073		7 .628082	072		7 .635182	071		7 .642168	069		7 .649043	068	
8 .620968	083		8 .628184	082		8 .635283	081		8 .642267	079		8 .649140	078	
9 .621072	094		9 .628287	092		9 .635383	091		9 .642366	089		9 .649237	088	
4180 .621176	000		4250 .628389	000		4320 .635484	000		4390 .642464	000		4460 .649335	000	
1 .621280	010		1 .628491	010		1 .635584	010		1 .642563	010		1 .649432	010	
2 .621384	021		2 .628593	020		2 .635685	020		2 .642662	020		2 .649530	019	
3 .621488	031		3 .628695	031		3 .635785	030		3 .642761	030		3 .649627	029	
4 .621592	042		4 .628797	041		4 .635886	040		4 .642860	040		4 .649724	039	
5 .621695	052		5 .628900	051		5 .635986	050		5 .642959	049		5 .649821	049	
6 .621799	062		6 .629002	061		6 .636086	060		6 .643058	059		6 .649919	058	
7 .621903	073		7 .629104	072		7 .636187	070		7 .643156	069		7 .650016	068	
8 .622007	083		8 .629206	082		8 .636287	080		8 .643255	079		8 .650113	078	
9 .622110	094		9 .629308	092		9 .636388	090		9 .643354	089		9 .650210	088	
4190 .622214	000		4260 .629410	000		4330 .636488	000		4400 .643453	000		4470 .650307	000	
1 .622318	010		1 .629511	010		1 .636588	010		1 .643551	010		1 .650405	010	
2 .622421	021		2 .629613	020		2 .636688	020		2 .643650	020		2 .650502	019	
3 .622525	031		3 .629715	030		3 .636789	030		3 .643749	030		3 .650599	029	
4 .622628	041		4 .629817	041		4 .636889	040		4 .643847	039		4 .650696	039	
5 .622732	052		5 .629919	051		5 .636989	050		5 .643946	049		5 .650793	049	
6 .622835	062		6 .630021	061		6 .637089	060		6 .644044	059		6 .650890	058	
7 .622939	072		7 .630123	071		7 .637189	070		7 .644143	069		7 .650987	068	
8 .623042	083		8 .630224	081		8 .637289	080		8 .644242	079		8 .651084	078	
9 .623146	093		9 .630326	091		9 .637390	090		9 .644340	089		9 .651181	088	
4200 .623249	000		4270 .630428	000		4340 .637490	000		4410 .644439	000		4480 .651278	000	
1 .623353	010		1 .630530	010		1 .637590	010		1 .644537	010		1 .651375	010	
2 .623456	021		2 .630631	020		2 .637690	020		2 .644635	020		2 .651472	019	
3 .623559	031		3 .630733	030		3 .637790	030		3 .644734	030		3 .651569	029	
4 .623663	041		4 .630834	041		4 .637890	040		4 .644832	039		4 .651666	038	
5 .623766	052		5 .630936	051		5 .637990	050		5 .644931	049		5 .651762	048	
6 .623869	062		6 .631038	061		6 .638090	060		6 .645029	059		6 .651859	058	
7 .623972	072		7 .631139	071		7 .638190	070		7 .645127	069		7 .651956	067	
8 .624076	083		8 .631241	081		8 .638289	080		8 .645226	079		8 .652053	077	
9 .624179	093		9 .631342	091		9 .638389	090		9 .645324	089		9 .652150	087	
4210 .624282	000		4280 .631444	000		4350 .638489	000		4420 .645422	000		4490 .652246	000	
1 .624385	010		1 .631545	010		1 .638589	010		1 .645520	010		1 .652343	010	
2 .624488	021		2 .631647	020		2 .638689	020		2 .645619	020		2 .652440	019	
3 .624591	031		3 .631748	030		3 .638789	030		3 .645717	030		3 .652536	029	
4 .624694	041		4 .631849	041		4 .638888	040		4 .645815	039		4 .652633	038	
5 .624798	051		5 .631951	051		5 .638988	050		5 .645913	049		5 .652730	048	
6 .624901	062		6 .632052	061		6 .639088	060		6 .646011	059		6 .652826	058	
7 .625004	072		7 .632153	071		7 .639188	070		7 .646109	069		7 .652923	067	
8 .625107	083		8 .632255	081		8 .639287	080		8 .646208	079		8 .653019	077	
9 .625209	093		9 .632356	091		9 .639387	090		9 .646306	089		9 .653116	087	

(u.)

Log. .653213 to .685652

No. 4500 to 4849.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
4500	.653213	000	4570	.659916	000	4640	.666518	000	4710	.673021	000	4780	.679428	000
1	.653309	010	1	.660011	010	1	.666612	009	1	.673113	009	1	.679519	009
2	.653405	019	2	.660106	019	2	.666705	019	2	.673205	018	2	.679610	018
3	.653502	029	3	.660201	028	3	.666799	028	3	.673297	028	3	.679700	027
4	.653598	038	4	.660296	038	4	.666892	037	4	.673390	037	4	.679791	036
5	.653695	048	5	.660391	047	5	.666986	047	5	.673482	046	5	.679882	045
6	.653791	058	6	.660486	057	6	.667079	056	6	.673574	055	6	.679973	055
7	.653888	067	7	.660581	067	7	.667173	065	7	.673666	064	7	.680063	064
8	.653984	077	8	.660676	076	8	.667266	074	8	.673758	074	8	.680154	073
9	.654080	087	9	.660771	086	9	.667359	084	9	.673850	083	9	.680245	082
4510	.654176	000	4580	.660865	000	4650	.667453	000	4720	.673942	000	4790	.680335	000
1	.654273	010	1	.660960	009	1	.667546	009	1	.674034	009	1	.680426	009
2	.654369	019	2	.661055	019	2	.667640	019	2	.674126	018	2	.680517	018
3	.654465	029	3	.661150	028	3	.667733	028	3	.674218	028	3	.680607	027
4	.654562	038	4	.661245	038	4	.667826	037	4	.674310	037	4	.680698	036
5	.654658	048	5	.661339	047	5	.667920	047	5	.674402	046	5	.680789	045
6	.654754	058	6	.661434	057	6	.668013	056	6	.674494	055	6	.680879	055
7	.654850	067	7	.661529	066	7	.668106	065	7	.674586	064	7	.680970	064
8	.654946	077	8	.661623	076	8	.668199	074	8	.674677	074	8	.681060	073
9	.655042	086	9	.661718	085	9	.668293	084	9	.674769	083	9	.681151	082
4520	.655138	000	4590	.661813	000	4660	.668386	000	4730	.674861	000	4800	.681241	000
1	.655234	010	1	.661907	009	1	.668479	009	1	.674953	009	1	.681332	009
2	.655331	019	2	.662002	019	2	.668572	019	2	.675045	018	2	.681422	018
3	.655427	029	3	.662096	028	3	.668665	028	3	.675136	028	3	.681513	027
4	.655523	038	4	.662191	038	4	.668758	037	4	.675228	037	4	.681603	036
5	.655619	048	5	.662285	047	5	.668852	047	5	.675320	046	5	.681693	045
6	.655714	058	6	.662380	057	6	.668945	056	6	.675412	055	6	.681784	054
7	.655810	067	7	.662474	066	7	.669038	065	7	.675503	064	7	.681874	063
8	.655906	077	8	.662569	076	8	.669131	074	8	.675595	074	8	.681964	072
9	.656002	086	9	.662663	085	9	.669224	084	9	.675687	083	9	.682055	081
4530	.656098	000	4600	.662758	000	4670	.669317	000	4740	.675778	000	4810	.682145	000
1	.656194	010	1	.662852	009	1	.669410	009	1	.675870	009	1	.682235	009
2	.656290	019	2	.662947	019	2	.669503	019	2	.675961	018	2	.682326	018
3	.656386	029	3	.663041	028	3	.669596	028	3	.676053	027	3	.682416	027
4	.656481	038	4	.663135	038	4	.669689	037	4	.676145	036	4	.682506	036
5	.656577	048	5	.663230	047	5	.669782	047	5	.676236	046	5	.682596	045
6	.656673	058	6	.663324	057	6	.669875	056	6	.676328	055	6	.682686	054
7	.656769	067	7	.663418	066	7	.669967	065	7	.676419	064	7	.682777	063
8	.656864	077	8	.663512	076	8	.670060	074	8	.676511	073	8	.682867	072
9	.656960	086	9	.663607	085	9	.670153	084	9	.676602	082	9	.682957	081
4540	.657056	000	4610	.663701	000	4680	.670246	000	4750	.676694	000	4820	.683047	000
1	.657151	010	1	.663795	009	1	.670339	009	1	.676785	009	1	.683137	009
2	.657247	019	2	.663889	019	2	.670431	018	2	.676876	018	2	.683227	018
3	.657343	028	3	.663983	028	3	.670524	028	3	.676968	027	3	.683317	027
4	.657438	038	4	.664078	038	4	.670617	037	4	.677059	036	4	.683407	036
5	.657534	047	5	.664172	047	5	.670710	046	5	.677150	046	5	.683497	045
6	.657629	057	6	.664266	056	6	.670802	055	6	.677242	055	6	.683587	054
7	.657725	067	7	.664360	066	7	.670895	064	7	.677333	064	7	.683677	063
8	.657820	076	8	.664454	075	8	.670988	074	8	.677424	073	8	.683767	072
9	.657916	086	9	.664548	085	9	.671080	083	9	.677516	082	9	.683857	081
4550	.658011	000	4620	.664642	000	4690	.671173	000	4760	.677607	000	4830	.683947	000
1	.658107	010	1	.664736	009	1	.671265	009	1	.677698	009	1	.684037	009
2	.658202	019	2	.664830	019	2	.671358	018	2	.677789	018	2	.684127	018
3	.658298	028	3	.664924	028	3	.671451	028	3	.677881	027	3	.684217	027
4	.658393	038	4	.665018	038	4	.671543	037	4	.677972	036	4	.684307	036
5	.658488	047	5	.665112	047	5	.671636	046	5	.678063	045	5	.684396	045
6	.658584	057	6	.665206	056	6	.671728	055	6	.678154	055	6	.684486	054
7	.658679	067	7	.665299	066	7	.671821	064	7	.678245	064	7	.684576	063
8	.658774	076	8	.665393	075	8	.671913	074	8	.678336	073	8	.684666	072
9	.658870	086	9	.665487	085	9	.672005	083	9	.678427	082	9	.684756	081
4560	.658965	000	4630	.665581	000	4700	.672098	000	4770	.678518	000	4840	.684845	000
1	.659060	010	1	.665675	009	1	.672190	009	1	.678609	009	1	.684935	009
2	.659155	019	2	.665769	019	2	.672283	018	2	.678700	018	2	.685025	018
3	.659250	028	3	.665862	028	3	.672375	028	3	.678791	027	3	.685114	027
4	.659346	038	4	.665956	038	4	.672467	037	4	.678882	036	4	.685204	036
5	.659441	047	5	.666050	047	5	.672560	046	5	.678973	045	5	.685294	045
6	.659536	057	6	.666143	056	6	.672652	055	6	.679064	055	6	.685383	054
7	.659631	067	7	.666237	066	7	.672744	064	7	.679155	064	7	.685473	063
8	.659726	076	8	.666331	075	8	.672836	074	8	.679246	073	8	.685563	072
9	.659821	086	9	.666424	085	9	.672929	083	9	.679337	082	9	.685652	081

Log. .685742 to .715920

No. 4850 to 5199.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
4850	.685742	00	4920	.691965	00	4990	.698100	00	5060	.704150	00	5130	.710117	00
1	.685831	09	1	.692053	09	1	.698188	09	1	.704236	09	1	.710202	08
2	.685921	18	2	.692142	18	2	.698275	17	2	.704322	17	2	.710287	17
3	.686010	27	3	.692230	27	3	.698362	26	3	.704408	26	3	.710371	25
4	.686100	36	4	.692318	35	4	.698448	35	4	.704494	34	4	.710456	34
5	.686189	45	5	.692406	44	5	.698535	44	5	.704579	43	5	.710540	42
6	.686279	54	6	.692494	53	6	.698622	52	6	.704665	52	6	.710625	51
7	.686368	63	7	.692583	62	7	.698709	61	7	.704751	60	7	.710710	59
8	.686457	72	8	.692671	71	8	.698796	70	8	.704837	69	8	.710794	68
9	.686547	81	9	.692759	80	9	.698883	79	9	.704922	77	9	.710879	76
4860	.686636	00	4930	.692847	00	5000	.698970	00	5070	.705008	00	5140	.710963	00
1	.686726	09	1	.692935	09	1	.699057	09	1	.705094	09	1	.711048	08
2	.686815	18	2	.693023	18	2	.699144	17	2	.705179	17	2	.711132	17
3	.686904	27	3	.693111	26	3	.699230	26	3	.705265	26	3	.711216	25
4	.686994	36	4	.693199	35	4	.699317	35	4	.705350	34	4	.711301	34
5	.687083	45	5	.693287	44	5	.699404	43	5	.705436	43	5	.711385	42
6	.687172	54	6	.693375	53	6	.699491	52	6	.705522	52	6	.711470	51
7	.687261	63	7	.693463	62	7	.699578	61	7	.705607	60	7	.711554	59
8	.687351	72	8	.693551	70	8	.699664	70	8	.705693	69	8	.711638	68
9	.687440	81	9	.693639	79	9	.699751	78	9	.705778	77	9	.711723	76
4870	.687529	00	4940	.693727	00	5010	.699838	00	5080	.705864	00	5150	.711807	00
1	.687618	09	1	.693815	09	1	.699924	09	1	.705949	09	1	.711891	08
2	.687707	18	2	.693903	18	2	.700011	17	2	.706035	17	2	.711976	17
3	.687796	27	3	.693991	26	3	.700098	26	3	.706120	26	3	.712060	25
4	.687885	36	4	.694078	35	4	.700184	35	4	.706205	34	4	.712144	34
5	.687975	45	5	.694166	44	5	.700271	43	5	.706291	43	5	.712229	42
6	.688064	54	6	.694254	53	6	.700357	52	6	.706376	51	6	.712313	51
7	.688153	62	7	.694342	62	7	.700444	61	7	.706462	60	7	.712397	59
8	.688242	72	8	.694430	70	8	.700531	70	8	.706547	68	8	.712481	68
9	.688331	80	9	.694517	79	9	.700617	78	9	.706632	77	9	.712565	76
4880	.688420	00	4950	.694605	00	5020	.700704	00	5090	.706718	00	5160	.712650	00
1	.688509	09	1	.694693	09	1	.700790	09	1	.706803	09	1	.712734	08
2	.688598	18	2	.694781	18	2	.700877	17	2	.706888	17	2	.712818	17
3	.688687	27	3	.694868	26	3	.700963	26	3	.706974	26	3	.712902	25
4	.688776	36	4	.694956	35	4	.701050	35	4	.707059	34	4	.712986	34
5	.688865	45	5	.695044	44	5	.701136	43	5	.707144	43	5	.713070	42
6	.688953	54	6	.695131	53	6	.701222	52	6	.707229	51	6	.713154	50
7	.689042	62	7	.695219	62	7	.701309	61	7	.707315	60	7	.713238	59
8	.689131	72	8	.695306	70	8	.701395	70	8	.707400	68	8	.713322	67
9	.689220	80	9	.695394	79	9	.701482	78	9	.707485	77	9	.713406	76
4890	.689309	00	4960	.695482	00	5030	.701568	00	5100	.707570	00	5170	.713490	00
1	.689398	09	1	.695569	09	1	.701654	09	1	.707655	09	1	.713574	08
2	.689486	18	2	.695657	17	2	.701741	17	2	.707740	17	2	.713658	17
3	.689575	27	3	.695744	26	3	.701827	26	3	.707826	26	3	.713742	25
4	.689664	36	4	.695832	35	4	.701913	35	4	.707911	34	4	.713826	34
5	.689753	45	5	.695919	44	5	.701999	43	5	.707996	43	5	.713910	42
6	.689841	54	6	.696007	52	6	.702086	52	6	.708081	51	6	.713994	50
7	.689930	62	7	.696094	61	7	.702172	61	7	.708166	60	7	.714078	59
8	.690019	72	8	.696182	70	8	.702258	70	8	.708251	68	8	.714162	67
9	.690107	80	9	.696269	79	9	.702344	78	9	.708336	77	9	.714246	76
4900	.690196	00	4970	.696356	00	5040	.702430	00	5110	.708421	00	5180	.714330	00
1	.690285	09	1	.696444	09	1	.702517	09	1	.708506	09	1	.714414	08
2	.690373	18	2	.696531	17	2	.702603	17	2	.708591	17	2	.714497	17
3	.690462	27	3	.696618	26	3	.702689	26	3	.708676	26	3	.714581	25
4	.690550	35	4	.696706	35	4	.702775	34	4	.708761	34	4	.714665	34
5	.690639	44	5	.696793	44	5	.702861	43	5	.708846	43	5	.714749	42
6	.690727	53	6	.696880	52	6	.702947	52	6	.708931	51	6	.714832	50
7	.690816	62	7	.696968	61	7	.703033	60	7	.709015	60	7	.714916	59
8	.690905	71	8	.697055	70	8	.703119	69	8	.709100	68	8	.715000	67
9	.690993	80	9	.697142	79	9	.703205	77	9	.709185	77	9	.715084	76
4910	.691081	00	4980	.697229	00	5050	.703291	00	5120	.709270	00	5190	.715167	00
1	.691170	09	1	.697316	09	1	.703377	09	1	.709355	08	1	.715251	08
2	.691258	18	2	.697404	17	2	.703463	17	2	.709440	17	2	.715335	17
3	.691347	27	3	.697491	26	3	.703549	26	3	.709524	25	3	.715418	25
4	.691435	35	4	.697578	35	4	.703635	34	4	.709609	34	4	.715502	34
5	.691523	44	5	.697665	44	5	.703721	43	5	.709694	42	5	.715586	42
6	.691612	53	6	.697752	52	6	.703807	52	6	.709779	51	6	.715669	50
7	.691700	62	7	.697839	61	7	.703893	60	7	.709863	59	7	.715753	59
8	.691788	71	8	.697926	70	8	.703979	69	8	.709948	68	8	.715836	67
9	.691877	80	9	.698013	79	9	.704065	77	9	.710033	76	9	.715920	76

Log. .716003 to .744215

No. 5200 to 5549.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
5200	.716003	00	5270	.721811	00	5340	.727541	00	5410	.733197	00	5480	.738781	00
1	.716087	08	1	.721893	08	1	.727623	08	1	.733277	08	1	.738860	08
2	.716170	17	2	.721975	16	2	.727704	16	2	.733358	16	2	.738939	16
3	.716254	25	3	.722058	25	3	.727785	24	3	.733438	24	3	.739018	24
4	.716337	34	4	.722140	33	4	.727866	33	4	.733518	32	4	.739097	32
5	.716421	42	5	.722222	41	5	.727948	41	5	.733598	40	5	.739177	40
6	.716504	50	6	.722305	49	6	.728029	49	6	.733679	48	6	.739256	47
7	.716588	59	7	.722387	58	7	.728110	57	7	.733759	56	7	.739335	55
8	.716671	67	8	.722469	66	8	.728191	65	8	.733839	64	8	.739414	63
9	.716754	76	9	.722552	74	9	.728273	73	9	.733919	72	9	.739493	71
5210	.716838	00	5280	.722634	00	5350	.728354	00	5420	.733999	00	5490	.739572	00
1	.716921	08	1	.722716	08	1	.728435	08	1	.734079	08	1	.739651	08
2	.717004	17	2	.722798	16	2	.728516	16	2	.734159	16	2	.739730	16
3	.717088	25	3	.722881	25	3	.728597	24	3	.734240	24	3	.739810	24
4	.717171	33	4	.722963	33	4	.728678	33	4	.734320	32	4	.739889	32
5	.717254	42	5	.723045	41	5	.728759	41	5	.734400	40	5	.739968	40
6	.717338	50	6	.723127	49	6	.728841	49	6	.734480	48	6	.740047	47
7	.717421	58	7	.723209	58	7	.728922	57	7	.734560	56	7	.740126	55
8	.717504	66	8	.723291	66	8	.729003	65	8	.734640	64	8	.740205	63
9	.717587	75	9	.723374	74	9	.729084	73	9	.734720	72	9	.740284	71
5220	.717670	00	5290	.723456	00	5360	.729165	00	5430	.734800	00	5500	.740363	00
1	.717754	08	1	.723538	08	1	.729246	08	1	.734880	08	1	.740442	08
2	.717837	17	2	.723620	16	2	.729327	16	2	.734960	16	2	.740521	16
3	.717920	25	3	.723702	25	3	.729408	24	3	.735040	24	3	.740599	24
4	.718003	33	4	.723784	33	4	.729489	32	4	.735120	32	4	.740678	32
5	.718086	42	5	.723866	41	5	.729570	41	5	.735200	40	5	.740757	40
6	.718169	50	6	.723948	49	6	.729651	49	6	.735279	48	6	.740836	47
7	.718252	58	7	.724030	57	7	.729732	57	7	.735359	56	7	.740915	55
8	.718336	66	8	.724112	66	8	.729812	65	8	.735439	64	8	.740994	63
9	.718419	75	9	.724194	74	9	.729893	73	9	.735519	72	9	.741073	71
5230	.718502	00	5300	.724276	00	5370	.729974	00	5440	.735599	00	5510	.741152	00
1	.718585	08	1	.724358	08	1	.730055	08	1	.735679	08	1	.741230	08
2	.718668	17	2	.724440	16	2	.730136	16	2	.735758	16	2	.741309	16
3	.718751	25	3	.724522	25	3	.730217	24	3	.735838	24	3	.741388	24
4	.718834	33	4	.724603	33	4	.730298	32	4	.735918	32	4	.741467	32
5	.718917	42	5	.724685	41	5	.730378	40	5	.735998	40	5	.741545	40
6	.719000	50	6	.724767	49	6	.730459	49	6	.736078	48	6	.741624	47
7	.719083	58	7	.724849	57	7	.730540	57	7	.736157	56	7	.741703	55
8	.719165	66	8	.724931	66	8	.730621	65	8	.736237	64	8	.741782	63
9	.719248	75	9	.725013	74	9	.730701	73	9	.736317	72	9	.741860	71
5240	.719331	00	5310	.725094	00	5380	.730782	00	5450	.736396	00	5520	.741939	00
1	.719414	08	1	.725176	08	1	.730863	08	1	.736476	08	1	.742018	08
2	.719497	17	2	.725258	16	2	.730944	16	2	.736556	16	2	.742096	16
3	.719580	25	3	.725340	25	3	.731024	24	3	.736635	24	3	.742175	23
4	.719663	33	4	.725422	33	4	.731105	32	4	.736715	32	4	.742254	31
5	.719745	41	5	.725503	41	5	.731186	40	5	.736795	40	5	.742332	39
6	.719828	50	6	.725585	49	6	.731266	49	6	.736874	48	6	.742411	47
7	.719911	58	7	.725667	57	7	.731347	57	7	.736954	56	7	.742489	55
8	.719994	66	8	.725748	66	8	.731428	65	8	.737033	64	8	.742568	63
9	.720077	75	9	.725830	74	9	.731508	73	9	.737113	72	9	.742647	71
5250	.720159	00	5320	.725912	00	5390	.731589	00	5460	.737193	00	5530	.742725	00
1	.720242	08	1	.725993	08	1	.731669	08	1	.737272	08	1	.742804	08
2	.720325	17	2	.726075	16	2	.731750	16	2	.737352	16	2	.742882	16
3	.720407	25	3	.726156	24	3	.731830	24	3	.737431	24	3	.742961	23
4	.720490	33	4	.726238	33	4	.731911	32	4	.737511	32	4	.743039	31
5	.720573	41	5	.726320	41	5	.731991	40	5	.737590	40	5	.743118	39
6	.720655	50	6	.726401	49	6	.732072	48	6	.737670	48	6	.743196	47
7	.720738	58	7	.726483	57	7	.732152	56	7	.737749	56	7	.743274	55
8	.720821	66	8	.726564	65	8	.732233	64	8	.737828	64	8	.743353	63
9	.720903	75	9	.726646	73	9	.732313	72	9	.737908	72	9	.743431	71
5260	.720986	00	5330	.726727	00	5400	.732394	00	5470	.737987	00	5540	.743510	00
1	.721068	08	1	.726809	08	1	.732474	08	1	.738067	08	1	.743588	08
2	.721151	16	2	.726890	16	2	.732555	16	2	.738146	16	2	.743666	16
3	.721233	25	3	.726972	24	3	.732635	24	3	.738225	24	3	.743745	23
4	.721316	33	4	.727053	33	4	.732715	32	4	.738305	32	4	.743823	31
5	.721398	41	5	.727134	41	5	.732796	40	5	.738384	40	5	.743902	39
6	.721481	49	6	.727216	49	6	.732876	48	6	.738463	48	6	.743980	47
7	.721563	58	7	.727297	57	7	.732956	56	7	.738543	56	7	.744058	55
8	.721646	66	8	.727379	65	8	.733037	64	8	.738622	64	8	.744136	63
9	.721728	74	9	.727460	73	9	.733117	72	9	.738701	72	9	.744215	71

Log. .744293 to .770778

No. 5550 to 5899.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
5550	.744293	00	5620	.749736	00	5690	.755112	00	5760	.760422	00	5830	.765669	00
1	.744371	08	1	.749814	08	1	.755189	08	1	.760498	08	1	.765743	07
2	.744449	16	2	.749891	16	2	.755265	15	2	.760573	15	2	.765817	15
3	.744528	23	3	.749968	23	3	.755341	23	3	.760649	23	3	.765892	22
4	.744606	31	4	.750045	31	4	.755417	30	4	.760724	30	4	.765966	30
5	.744684	39	5	.750122	39	5	.755494	38	5	.760799	38	5	.766041	37
6	.744762	47	6	.750200	47	6	.755570	46	6	.760875	45	6	.766115	45
7	.744840	55	7	.750277	54	7	.755646	53	7	.760950	53	7	.766190	52
8	.744918	63	8	.750354	62	8	.755722	61	8	.761025	60	8	.766264	60
9	.744997	71	9	.750431	70	9	.755799	69	9	.761100	68	9	.766338	67
5560	.745075	00	5630	.750508	00	5700	.755875	00	5770	.761176	00	5840	.766413	00
1	.745153	08	1	.750585	08	1	.755951	08	1	.761251	08	1	.766487	07
2	.745231	16	2	.750663	16	2	.756027	15	2	.761326	15	2	.766562	15
3	.745309	23	3	.750740	23	3	.756103	23	3	.761402	23	3	.766636	22
4	.745387	31	4	.750817	31	4	.756179	30	4	.761477	30	4	.766710	30
5	.745465	39	5	.750894	39	5	.756256	38	5	.761552	38	5	.766784	37
6	.745543	47	6	.750971	47	6	.756332	46	6	.761627	45	6	.766859	45
7	.745621	55	7	.751048	54	7	.756408	53	7	.761702	53	7	.766933	52
8	.745699	62	8	.751125	62	8	.756484	61	8	.761777	60	8	.767007	60
9	.745777	70	9	.751202	70	9	.756560	69	9	.761853	68	9	.767082	67
5570	.745855	00	5640	.751279	00	5710	.756636	00	5780	.761928	00	5850	.767156	00
1	.745933	08	1	.751356	08	1	.756712	08	1	.762003	08	1	.767230	07
2	.746011	16	2	.751433	15	2	.756788	15	2	.762078	15	2	.767304	15
3	.746089	23	3	.751510	23	3	.756864	23	3	.762153	22	3	.767378	22
4	.746167	31	4	.751587	30	4	.756940	30	4	.762228	30	4	.767453	30
5	.746245	39	5	.751664	38	5	.757016	38	5	.762303	38	5	.767527	37
6	.746323	47	6	.751741	46	6	.757092	46	6	.762378	45	6	.767601	45
7	.746401	55	7	.751818	54	7	.757168	53	7	.762453	52	7	.767675	52
8	.746478	62	8	.751895	62	8	.757244	61	8	.762528	60	8	.767749	59
9	.746556	70	9	.751972	70	9	.757320	69	9	.762603	68	9	.767823	67
5580	.746634	00	5650	.752048	00	5720	.757396	00	5790	.762679	00	5860	.767898	00
1	.746712	08	1	.752125	08	1	.757472	08	1	.762754	08	1	.767972	07
2	.746790	16	2	.752202	15	2	.757548	15	2	.762829	15	2	.768046	15
3	.746868	23	3	.752279	23	3	.757624	23	3	.762903	22	3	.768120	22
4	.746945	31	4	.752356	30	4	.757700	30	4	.762978	30	4	.768194	30
5	.747023	39	5	.752433	38	5	.757775	38	5	.763053	38	5	.768268	37
6	.747101	47	6	.752509	46	6	.757851	46	6	.763128	45	6	.768342	45
7	.747179	55	7	.752586	54	7	.757927	53	7	.763203	52	7	.768416	52
8	.747256	62	8	.752663	62	8	.758003	61	8	.763278	60	8	.768490	59
9	.747334	70	9	.752740	70	9	.758079	68	9	.763353	68	9	.768564	67
5590	.747412	00	5660	.752816	00	5730	.758155	00	5800	.763428	00	5870	.768638	00
1	.747489	08	1	.752893	08	1	.758230	08	1	.763503	07	1	.768712	07
2	.747567	16	2	.752970	15	2	.758306	15	2	.763578	15	2	.768786	15
3	.747645	23	3	.753047	23	3	.758382	23	3	.763653	22	3	.768860	22
4	.747722	31	4	.753123	30	4	.758458	30	4	.763727	30	4	.768934	30
5	.747800	39	5	.753200	38	5	.758533	38	5	.763802	37	5	.769008	37
6	.747878	47	6	.753277	46	6	.758609	46	6	.763877	45	6	.769082	45
7	.747955	54	7	.753353	54	7	.758685	53	7	.763952	52	7	.769156	52
8	.748033	62	8	.753430	62	8	.758760	61	8	.764027	60	8	.769230	59
9	.748110	70	9	.753506	70	9	.758836	68	9	.764101	67	9	.769303	67
5600	.748188	00	5670	.753583	00	5740	.758912	00	5810	.764176	00	5880	.769377	00
1	.748266	08	1	.753660	08	1	.758987	08	1	.764251	07	1	.769451	07
2	.748343	16	2	.753736	15	2	.759063	15	2	.764326	15	2	.769525	15
3	.748421	23	3	.753813	23	3	.759139	23	3	.764400	22	3	.769599	22
4	.748498	31	4	.753889	30	4	.759214	30	4	.764475	30	4	.769673	30
5	.748576	39	5	.753966	38	5	.759290	38	5	.764550	37	5	.769746	37
6	.748653	47	6	.754042	46	6	.759366	45	6	.764624	45	6	.769820	45
7	.748731	54	7	.754119	54	7	.759441	53	7	.764699	52	7	.769894	52
8	.748808	62	8	.754195	62	8	.759517	60	8	.764774	60	8	.769968	59
9	.748885	70	9	.754272	70	9	.759592	68	9	.764848	67	9	.770042	67
5610	.748963	00	5680	.754348	00	5750	.759668	00	5820	.764923	00	5890	.770115	00
1	.749040	08	1	.754425	08	1	.759743	08	1	.764998	07	1	.770189	07
2	.749118	16	2	.754501	15	2	.759819	15	2	.765072	15	2	.770263	15
3	.749195	23	3	.754578	23	3	.759894	23	3	.765147	22	3	.770336	22
4	.749272	31	4	.754654	30	4	.759970	30	4	.765221	30	4	.770410	30
5	.749350	39	5	.754730	38	5	.760045	38	5	.765296	37	5	.770484	37
6	.749427	47	6	.754807	46	6	.760121	45	6	.765370	45	6	.770557	45
7	.749504	54	7	.754883	53	7	.760196	53	7	.765445	52	7	.770631	52
8	.749582	62	8	.754960	61	8	.760272	60	8	.765519	60	8	.770705	59
9	.749659	70	9	.755036	69	9	.760347	68	9	.765594	67	9	.770778	67

Log. .770852 to .795810

No. 5900 to 6249.

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No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
5900	.770852	00	5970	.775974	00	6040	.781037	00	6110	.786041	00	6180	.790938	00
1	.770926	07	1	.776047	07	1	.781109	07	1	.786112	07	1	.791059	07
2	.770999	15	2	.776120	15	2	.781181	14	2	.786183	14	2	.791129	14
3	.771073	22	3	.776192	22	3	.781253	22	3	.786254	21	3	.791199	21
4	.771146	30	4	.776265	29	4	.781324	29	4	.786325	28	4	.791269	28
5	.771220	37	5	.776338	37	5	.781396	36	5	.786396	36	5	.791340	35
6	.771293	45	6	.776411	44	6	.781468	43	6	.786467	43	6	.791410	42
7	.771367	52	7	.776483	51	7	.781540	50	7	.786538	50	7	.791480	49
8	.771440	59	8	.776556	59	8	.781612	58	8	.786609	57	8	.791550	56
9	.771514	67	9	.776629	66	9	.781684	65	9	.786680	64	9	.791620	63
5910	.771587	00	5980	.776701	00	6050	.781755	00	6120	.786751	00	6190	.791691	00
1	.771661	07	1	.776774	07	1	.781827	07	1	.786822	07	1	.791761	07
2	.771734	15	2	.776846	14	2	.781899	14	2	.786893	14	2	.791831	14
3	.771808	22	3	.776919	22	3	.781971	22	3	.786964	21	3	.791901	21
4	.771881	30	4	.776992	29	4	.782042	29	4	.787035	28	4	.791971	28
5	.771955	37	5	.777064	36	5	.782114	36	5	.787106	36	5	.792041	35
6	.772028	44	6	.777137	43	6	.782186	43	6	.787177	43	6	.792111	42
7	.772102	52	7	.777209	51	7	.782258	50	7	.787248	50	7	.792181	49
8	.772175	59	8	.777282	58	8	.782329	58	8	.787319	57	8	.792252	56
9	.772248	67	9	.777354	65	9	.782401	65	9	.787390	64	9	.792322	63
5920	.772322	00	5990	.777427	00	6060	.782473	00	6130	.787460	00	6200	.792392	00
1	.772395	07	1	.777499	07	1	.782544	07	1	.787531	07	1	.792462	07
2	.772468	15	2	.777572	14	2	.782616	14	2	.787602	14	2	.792532	14
3	.772542	22	3	.777644	22	3	.782688	21	3	.787673	21	3	.792602	21
4	.772615	29	4	.777717	29	4	.782759	29	4	.787744	28	4	.792672	28
5	.772688	37	5	.777789	36	5	.782831	36	5	.787815	35	5	.792742	35
6	.772762	44	6	.777862	43	6	.782902	43	6	.787885	42	6	.792812	42
7	.772835	51	7	.777934	51	7	.782974	50	7	.787956	49	7	.792882	49
8	.772908	59	8	.778006	58	8	.783046	57	8	.788027	56	8	.792952	56
9	.772981	66	9	.778079	65	9	.783117	64	9	.788098	63	9	.793022	63
5930	.773055	00	6000	.778151	00	6070	.783189	00	6140	.788168	00	6210	.793092	00
1	.773128	07	1	.778224	07	1	.783260	07	1	.788239	07	1	.793161	07
2	.773201	15	2	.778296	14	2	.783332	14	2	.788310	14	2	.793231	14
3	.773274	22	3	.778368	22	3	.783403	21	3	.788380	21	3	.793301	21
4	.773347	29	4	.778441	29	4	.783475	29	4	.788451	28	4	.793371	28
5	.773421	37	5	.778513	36	5	.783546	36	5	.788522	35	5	.793441	35
6	.773494	44	6	.778585	43	6	.783618	43	6	.788593	42	6	.793511	42
7	.773567	51	7	.778658	51	7	.783689	50	7	.788663	49	7	.793581	49
8	.773640	59	8	.778730	58	8	.783761	57	8	.788734	56	8	.793651	56
9	.773713	66	9	.778802	65	9	.783832	64	9	.788804	63	9	.793721	63
5940	.773786	00	6010	.778874	00	6080	.783904	00	6150	.788875	00	6220	.793790	00
1	.773860	07	1	.778947	07	1	.783975	07	1	.788946	07	1	.793860	07
2	.773933	15	2	.779019	14	2	.784046	14	2	.789016	14	2	.793930	14
3	.774006	22	3	.779091	22	3	.784118	21	3	.789087	21	3	.794000	21
4	.774079	29	4	.779163	29	4	.784189	29	4	.789157	28	4	.794070	28
5	.774152	37	5	.779236	36	5	.784261	36	5	.789228	35	5	.794139	35
6	.774225	44	6	.779308	43	6	.784332	43	6	.789299	42	6	.794209	42
7	.774298	51	7	.779380	51	7	.784403	50	7	.789369	49	7	.794279	49
8	.774371	59	8	.779452	58	8	.784475	57	8	.789440	56	8	.794349	56
9	.774444	66	9	.779524	65	9	.784546	64	9	.789510	63	9	.794418	63
5950	.774517	00	6020	.779596	00	6090	.784617	00	6160	.789581	00	6230	.794488	00
1	.774590	07	1	.779669	07	1	.784689	07	1	.789651	07	1	.794558	07
2	.774663	15	2	.779741	14	2	.784760	14	2	.789722	14	2	.794627	14
3	.774736	22	3	.779813	22	3	.784831	21	3	.789792	21	3	.794697	21
4	.774809	29	4	.779885	29	4	.784902	29	4	.789863	28	4	.794767	28
5	.774882	37	5	.779957	36	5	.784974	36	5	.789933	35	5	.794836	35
6	.774955	44	6	.780029	43	6	.785045	43	6	.790003	42	6	.794906	42
7	.775028	51	7	.780101	50	7	.785116	50	7	.790074	49	7	.794976	49
8	.775100	59	8	.780173	58	8	.785187	57	8	.790144	56	8	.795045	56
9	.775173	66	9	.780245	65	9	.785259	64	9	.790215	63	9	.795115	63
5960	.775246	00	6030	.780317	00	6100	.785330	00	6170	.790285	00	6240	.795185	00
1	.775319	07	1	.780389	07	1	.785401	07	1	.790355	07	1	.795254	07
2	.775392	15	2	.780461	14	2	.785472	14	2	.790426	14	2	.795324	14
3	.775465	22	3	.780533	22	3	.785543	21	3	.790496	21	3	.795393	21
4	.775538	29	4	.780605	29	4	.785614	28	4	.790567	28	4	.795463	28
5	.775610	37	5	.780677	36	5	.785686	36	5	.790637	35	5	.795532	35
6	.775683	44	6	.780749	43	6	.785757	43	6	.790707	42	6	.795602	42
7	.775756	51	7	.780821	50	7	.785828	50	7	.790778	49	7	.795677	49
8	.775829	59	8	.780893	58	8	.785899	57	8	.790848	56	8	.795741	56
9	.775902	66	9	.780965	65	9	.785970	64	9	.790918	63	9	.795810	63

Log. .795880 to .819478

No. 6250 to 6599.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
6250	.795880	00	6320	.800717	00	6390	.805501	00	6460	.810232	00	6530	.814913	00
1	.795949	07	1	.800786	07	1	.805569	07	1	.810300	07	1	.814980	07
2	.796019	14	2	.800854	14	2	.805637	14	2	.810367	13	2	.815046	13
3	.796088	21	3	.800923	21	3	.805705	20	3	.810434	20	3	.815113	20
4	.796158	28	4	.800992	28	4	.805773	27	4	.810501	27	4	.815179	26
5	.796227	35	5	.801060	34	5	.805840	34	5	.810568	33	5	.815246	33
6	.796297	42	6	.801129	41	6	.805908	41	6	.810636	40	6	.815312	40
7	.796366	49	7	.801198	48	7	.805976	48	7	.810703	47	7	.815378	46
8	.796436	56	8	.801266	55	8	.806044	54	8	.810770	54	8	.815445	53
9	.796505	63	9	.801335	62	9	.806112	61	9	.810837	60	9	.815511	60
6260	.796574	00	6330	.801404	00	6400	.806180	00	6470	.810904	00	6540	.815578	00
1	.796644	07	1	.801472	07	1	.806248	07	1	.810971	07	1	.815644	07
2	.796713	14	2	.801541	14	2	.806316	14	2	.811038	13	2	.815710	13
3	.796782	21	3	.801609	21	3	.806383	20	3	.811106	20	3	.815777	20
4	.796852	27	4	.801678	27	4	.806451	27	4	.811173	27	4	.815843	26
5	.796921	35	5	.801747	34	5	.806519	34	5	.811240	33	5	.815910	33
6	.796990	42	6	.801815	41	6	.806587	41	6	.811307	40	6	.815976	40
7	.797060	49	7	.801884	48	7	.806655	48	7	.811374	47	7	.816042	46
8	.797129	56	8	.801952	55	8	.806722	54	8	.811441	54	8	.816109	53
9	.797198	62	9	.802021	62	9	.806790	61	9	.811508	60	9	.816175	60
6270	.797267	00	6340	.802089	00	6410	.806858	00	6480	.811575	00	6550	.816241	00
1	.797337	07	1	.802158	07	1	.806926	07	1	.811642	07	1	.816308	07
2	.797406	14	2	.802226	14	2	.806993	14	2	.811709	13	2	.816374	13
3	.797475	21	3	.802295	21	3	.807061	20	3	.811776	20	3	.816440	20
4	.797544	27	4	.802363	27	4	.807129	27	4	.811843	27	4	.816506	26
5	.797614	35	5	.802432	34	5	.807197	34	5	.811910	33	5	.816573	33
6	.797683	42	6	.802500	41	6	.807264	41	6	.811977	40	6	.816639	40
7	.797752	49	7	.802568	48	7	.807332	48	7	.812044	47	7	.816705	46
8	.797821	56	8	.802637	55	8	.807400	54	8	.812111	54	8	.816771	53
9	.797890	62	9	.802705	62	9	.807467	61	9	.812178	60	9	.816838	60
6280	.797960	00	6350	.802774	00	6420	.807535	00	6490	.812245	00	6560	.816904	00
1	.798029	07	1	.802842	07	1	.807603	07	1	.812312	07	1	.816970	07
2	.798098	14	2	.802910	14	2	.807670	14	2	.812378	13	2	.817036	13
3	.798167	21	3	.802979	21	3	.807738	20	3	.812445	20	3	.817102	20
4	.798236	28	4	.803047	27	4	.807805	27	4	.812512	27	4	.817169	26
5	.798305	34	5	.803116	34	5	.807873	34	5	.812579	33	5	.817235	33
6	.798374	41	6	.803184	41	6	.807941	41	6	.812646	40	6	.817301	40
7	.798443	48	7	.803252	48	7	.808008	48	7	.812713	47	7	.817367	46
8	.798512	55	8	.803320	55	8	.808076	54	8	.812780	54	8	.817433	53
9	.798582	62	9	.803389	62	9	.808143	61	9	.812846	60	9	.817499	59
6290	.798651	00	6360	.803457	00	6430	.808211	00	6500	.812913	00	6570	.817565	00
1	.798720	07	1	.803525	07	1	.808278	07	1	.812980	07	1	.817631	07
2	.798789	14	2	.803594	14	2	.808346	14	2	.813047	13	2	.817698	13
3	.798858	21	3	.803662	21	3	.808414	20	3	.813114	20	3	.817764	20
4	.798927	28	4	.803730	27	4	.808481	27	4	.813180	27	4	.817830	26
5	.798996	34	5	.803798	34	5	.808549	34	5	.813247	33	5	.817896	33
6	.799065	41	6	.803867	41	6	.808616	41	6	.813314	40	6	.817962	40
7	.799134	48	7	.803935	48	7	.808683	48	7	.813381	47	7	.818028	46
8	.799203	55	8	.804003	55	8	.808751	54	8	.813447	54	8	.818094	53
9	.799272	62	9	.804071	62	9	.808818	61	9	.813514	60	9	.818160	59
6300	.799340	00	6370	.804139	00	6440	.808886	00	6510	.813581	00	6580	.818226	00
1	.799409	07	1	.804208	07	1	.808953	07	1	.813648	07	1	.818292	07
2	.799478	14	2	.804276	14	2	.809021	13	2	.813714	13	2	.818358	13
3	.799547	21	3	.804344	21	3	.809088	20	3	.813781	20	3	.818424	20
4	.799616	28	4	.804412	27	4	.809155	27	4	.813848	27	4	.818490	26
5	.799685	34	5	.804480	34	5	.809223	34	5	.813914	33	5	.818556	33
6	.799754	41	6	.804548	41	6	.809290	40	6	.813981	40	6	.818622	40
7	.799823	48	7	.804616	48	7	.809358	47	7	.814048	47	7	.818688	46
8	.799892	55	8	.804684	55	8	.809425	54	8	.814114	54	8	.818754	53
9	.799960	62	9	.804753	62	9	.809492	61	9	.814181	60	9	.818819	59
6310	.800029	00	6380	.804821	00	6450	.809560	00	6520	.814248	00	6590	.818885	00
1	.800098	07	1	.804889	07	1	.809627	07	1	.814314	07	1	.818951	07
2	.800167	14	2	.804957	14	2	.809694	13	2	.814381	13	2	.819017	13
3	.800236	21	3	.805025	20	3	.809762	20	3	.814447	20	3	.819083	20
4	.800305	28	4	.805093	27	4	.809829	27	4	.814514	26	4	.819149	26
5	.800373	34	5	.805161	34	5	.809896	34	5	.814580	33	5	.819215	33
6	.800442	41	6	.805229	41	6	.809963	40	6	.814647	40	6	.819281	40
7	.800511	48	7	.805297	48	7	.810031	47	7	.814714	46	7	.819346	46
8	.800580	55	8	.805365	54	8	.810098	54	8	.814780	53	8	.819412	53
9	.800648	62	9	.805433	61	9	.810165	61	9	.814847	60	9	.819478	59

Log. 819544 to .841922

No. 6600 to 6949.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
6600	.819544	00	6670	.824126	00	6740	.828660	00	6810	.833147	00	6880	.837588	00
1	.819610	07	1	.824191	06	1	.828724	06	1	.833211	06	1	.837652	06
2	.819675	13	2	.824256	13	2	.828789	13	2	.833275	13	2	.837715	13
3	.819741	20	3	.824321	19	3	.828853	19	3	.833338	19	3	.837778	19
4	.819807	26	4	.824386	26	4	.828918	26	4	.833402	26	4	.837841	25
5	.819873	33	5	.824451	32	5	.828982	32	5	.833466	32	5	.837904	32
6	.819939	40	6	.824516	39	6	.829046	39	6	.833530	38	6	.837967	38
7	.820004	46	7	.824581	45	7	.829111	45	7	.833593	45	7	.838030	44
8	.820070	53	8	.824646	52	8	.829175	52	8	.833657	51	8	.838093	50
9	.820136	59	9	.824711	58	9	.829239	58	9	.833721	58	9	.838156	57
6610	.820201	00	6680	.824776	00	6750	.829304	00	6820	.833784	00	6890	.838219	00
1	.820267	07	1	.824841	06	1	.829368	06	1	.833848	06	1	.838282	06
2	.820333	13	2	.824906	13	2	.829432	13	2	.833912	13	2	.838345	13
3	.820398	20	3	.824971	19	3	.829497	19	3	.833975	19	3	.838408	19
4	.820464	26	4	.825036	26	4	.829561	26	4	.834039	26	4	.838471	25
5	.820530	33	5	.825101	32	5	.829625	32	5	.834103	32	5	.838534	32
6	.820595	40	6	.825166	39	6	.829690	39	6	.834166	38	6	.838597	38
7	.820661	46	7	.825231	45	7	.829754	45	7	.834230	45	7	.838660	44
8	.820727	53	8	.825296	52	8	.829818	52	8	.834293	51	8	.838723	50
9	.820792	59	9	.825361	58	9	.829882	58	9	.834357	58	9	.838786	57
6620	.820858	00	6690	.825426	00	6760	.829947	00	6830	.834421	00	6900	.838849	00
1	.820924	07	1	.825491	06	1	.830011	06	1	.834484	06	1	.838912	06
2	.820989	13	2	.825556	13	2	.830075	13	2	.834548	13	2	.838975	13
3	.821055	20	3	.825621	19	3	.830139	19	3	.834611	19	3	.839038	19
4	.821120	26	4	.825686	26	4	.830204	26	4	.834675	25	4	.839101	25
5	.821186	33	5	.825751	32	5	.830268	32	5	.834738	32	5	.839164	31
6	.821251	40	6	.825815	39	6	.830332	38	6	.834802	38	6	.839227	38
7	.821317	46	7	.825880	45	7	.830396	45	7	.834866	45	7	.839289	44
8	.821382	53	8	.825945	52	8	.830460	51	8	.834929	51	8	.839352	50
9	.821448	59	9	.826010	58	9	.830524	58	9	.834993	58	9	.839415	57
6630	.821513	00	6700	.826075	00	6770	.830589	00	6840	.835056	00	6910	.839478	00
1	.821579	07	1	.826140	06	1	.830653	06	1	.835120	06	1	.839541	06
2	.821644	13	2	.826204	13	2	.830717	13	2	.835183	13	2	.839604	13
3	.821710	20	3	.826269	19	3	.830781	19	3	.835246	19	3	.839667	19
4	.821775	26	4	.826334	26	4	.830845	26	4	.835310	26	4	.839729	25
5	.821841	33	5	.826399	32	5	.830909	32	5	.835373	32	5	.839792	31
6	.821906	39	6	.826463	39	6	.830973	38	6	.835437	38	6	.839855	38
7	.821972	46	7	.826528	45	7	.831037	45	7	.835500	45	7	.839918	44
8	.822037	52	8	.826593	52	8	.831102	51	8	.835564	51	8	.839981	50
9	.822103	59	9	.826658	58	9	.831166	58	9	.835627	58	9	.840043	57
6640	.822168	00	6710	.826722	00	6780	.831230	00	6850	.835691	00	6920	.840106	00
1	.822233	07	1	.826787	06	1	.831294	06	1	.835754	06	1	.840169	06
2	.822299	13	2	.826852	13	2	.831358	13	2	.835817	13	2	.840232	13
3	.822364	20	3	.826917	19	3	.831422	19	3	.835881	19	3	.840294	19
4	.822430	26	4	.826981	26	4	.831486	26	4	.835944	26	4	.840357	25
5	.822495	33	5	.827046	32	5	.831550	32	5	.836007	32	5	.840420	31
6	.822560	39	6	.827111	39	6	.831614	38	6	.836071	38	6	.840482	38
7	.822626	46	7	.827175	45	7	.831678	45	7	.836134	45	7	.840545	44
8	.822691	52	8	.827240	52	8	.831742	51	8	.836197	51	8	.840608	50
9	.822756	59	9	.827305	58	9	.831806	58	9	.836261	58	9	.840671	57
6650	.822822	00	6720	.827369	00	6790	.831870	00	6860	.836324	00	6930	.840733	00
1	.822887	07	1	.827434	06	1	.831934	06	1	.836387	06	1	.840796	06
2	.822952	13	2	.827498	13	2	.831998	13	2	.836451	13	2	.840859	13
3	.823017	20	3	.827563	19	3	.832062	19	3	.836514	19	3	.840921	19
4	.823083	26	4	.827628	26	4	.832125	26	4	.836577	26	4	.840984	25
5	.823148	33	5	.827692	32	5	.832189	32	5	.836640	32	5	.841046	31
6	.823213	39	6	.827757	39	6	.832253	38	6	.836704	38	6	.841109	38
7	.823279	46	7	.827821	45	7	.832317	45	7	.836767	45	7	.841172	44
8	.823344	52	8	.827886	52	8	.832381	51	8	.836830	51	8	.841234	50
9	.823409	59	9	.827950	58	9	.832445	58	9	.836893	58	9	.841297	57
6660	.823474	00	6730	.828015	00	6800	.832509	00	6870	.836957	00	6940	.841359	00
1	.823539	07	1	.828080	06	1	.832573	06	1	.837020	06	1	.841422	06
2	.823605	13	2	.828144	13	2	.832637	13	2	.837083	13	2	.841485	13
3	.823670	20	3	.828209	19	3	.832700	19	3	.837146	19	3	.841547	19
4	.823735	26	4	.828273	26	4	.832764	26	4	.837209	25	4	.841610	25
5	.823800	33	5	.828338	32	5	.832828	32	5	.837273	32	5	.841672	31
6	.823865	39	6	.828402	39	6	.832892	38	6	.837336	38	6	.841735	38
7	.823930	46	7	.828466	45	7	.832956	45	7	.837399	44	7	.841797	44
8	.823996	52	8	.828531	52	8	.833019	51	8	.837462	51	8	.841860	50
9	.824061	59	9	.828595	58	9	.833083	58	9	.837525	57	9	.841922	56

Log. .841985 to .863263

No. 6950 to 7299.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
6950	.841985	00	7020	.846337	00	7090	.850646	00	7160	.854913	00	7230	.859138	00
1	.842047	06	1	.846399	06	1	.850707	06	1	.854974	06	1	.859198	06
2	.842110	12	2	.846461	12	2	.850769	12	2	.855034	12	2	.859258	12
3	.842172	19	3	.846523	19	3	.850830	18	3	.855095	18	3	.859318	18
4	.842235	25	4	.846584	25	4	.850891	25	4	.855156	24	4	.859378	24
5	.842297	31	5	.846646	31	5	.850952	31	5	.855216	30	5	.859438	30
6	.842360	37	6	.846708	37	6	.851014	37	6	.855277	36	6	.859499	36
7	.842422	44	7	.846770	43	7	.851075	43	7	.855337	42	7	.859559	42
8	.842484	50	8	.846832	50	8	.851136	49	8	.855398	48	8	.859619	48
9	.842547	56	9	.846893	56	9	.851197	55	9	.855459	54	9	.859679	54
6960	.842609	00	7030	.846955	00	7100	.851258	00	7170	.855519	00	7240	.859739	00
1	.842672	06	1	.847017	06	1	.851319	06	1	.855580	06	1	.859798	06
2	.842734	12	2	.847079	12	2	.851381	12	2	.855640	12	2	.859858	12
3	.842796	19	3	.847141	19	3	.851442	18	3	.855701	18	3	.859918	18
4	.842859	25	4	.847202	25	4	.851503	25	4	.855761	24	4	.859978	24
5	.842921	31	5	.847264	31	5	.851564	31	5	.855822	30	5	.860038	30
6	.842983	37	6	.847326	37	6	.851625	37	6	.855882	36	6	.860098	36
7	.843046	44	7	.847388	43	7	.851686	43	7	.855943	42	7	.860158	42
8	.843108	50	8	.847449	50	8	.851747	49	8	.856003	48	8	.860218	48
9	.843170	56	9	.847511	56	9	.851808	55	9	.856064	54	9	.860278	54
6970	.843233	00	7040	.847573	00	7110	.851870	00	7180	.856124	00	7250	.860338	00
1	.843295	06	1	.847634	06	1	.851931	06	1	.856185	06	1	.860398	06
2	.843357	12	2	.847696	12	2	.851992	12	2	.856245	12	2	.860458	12
3	.843420	19	3	.847758	18	3	.852053	18	3	.856306	18	3	.860518	18
4	.843482	25	4	.847819	25	4	.852114	25	4	.856366	24	4	.860578	24
5	.843544	31	5	.847881	31	5	.852175	31	5	.856427	30	5	.860637	30
6	.843606	37	6	.847943	37	6	.852236	37	6	.856487	36	6	.860697	36
7	.843669	43	7	.848004	43	7	.852297	43	7	.856548	42	7	.860757	42
8	.843731	50	8	.848066	49	8	.852358	49	8	.856608	48	8	.860817	48
9	.843793	56	9	.848127	55	9	.852419	55	9	.856668	54	9	.860877	54
6980	.843855	00	7050	.848189	00	7120	.852480	00	7190	.856729	00	7260	.860937	00
1	.843918	06	1	.848251	06	1	.852541	06	1	.856789	06	1	.860996	06
2	.843980	12	2	.848312	12	2	.852602	12	2	.856850	12	2	.861056	12
3	.844042	19	3	.848374	18	3	.852663	18	3	.856910	18	3	.861116	18
4	.844104	25	4	.848435	25	4	.852724	24	4	.856970	24	4	.861176	24
5	.844166	31	5	.848497	31	5	.852785	30	5	.857031	30	5	.861236	30
6	.844229	37	6	.848559	37	6	.852846	37	6	.857091	36	6	.861295	36
7	.844291	43	7	.848620	43	7	.852907	43	7	.857151	42	7	.861355	42
8	.844353	50	8	.848682	49	8	.852968	49	8	.857212	48	8	.861415	48
9	.844415	56	9	.848743	55	9	.853029	55	9	.857272	54	9	.861475	54
6990	.844477	00	7060	.848805	00	7130	.853089	00	7200	.857332	00	7270	.861534	00
1	.844539	06	1	.848866	06	1	.853150	06	1	.857393	06	1	.861594	06
2	.844601	12	2	.848928	12	2	.853211	12	2	.857453	12	2	.861654	12
3	.844663	19	3	.848989	18	3	.853272	18	3	.857513	18	3	.861714	18
4	.844726	25	4	.849051	25	4	.853333	24	4	.857574	24	4	.861774	24
5	.844788	31	5	.849112	31	5	.853394	30	5	.857634	30	5	.861833	30
6	.844850	37	6	.849174	37	6	.853455	37	6	.857694	36	6	.861893	36
7	.844912	43	7	.849235	43	7	.853516	43	7	.857754	42	7	.861952	42
8	.844974	50	8	.849296	49	8	.853576	49	8	.857815	48	8	.862012	48
9	.845036	56	9	.849358	55	9	.853637	55	9	.857875	54	9	.862072	54
7000	.845098	00	7070	.849419	00	7140	.853698	00	7210	.857935	00	7280	.862131	00
1	.845160	06	1	.849481	06	1	.853759	06	1	.857995	06	1	.862191	06
2	.845222	12	2	.849542	12	2	.853820	12	2	.858056	12	2	.862251	12
3	.845284	19	3	.849604	18	3	.853881	18	3	.858116	18	3	.862310	18
4	.845346	25	4	.849665	25	4	.853941	24	4	.858176	24	4	.862370	24
5	.845408	31	5	.849726	31	5	.854002	30	5	.858236	30	5	.862430	30
6	.845470	37	6	.849788	37	6	.854063	37	6	.858296	36	6	.862489	36
7	.845532	43	7	.849849	43	7	.854124	43	7	.858357	42	7	.862549	42
8	.845594	50	8	.849911	49	8	.854184	49	8	.858417	48	8	.862608	48
9	.845656	56	9	.849972	55	9	.854245	55	9	.858477	54	9	.862668	54
7010	.845718	00	7080	.850033	00	7150	.854306	00	7220	.858537	00	7290	.862727	00
1	.845780	06	1	.850095	06	1	.854367	06	1	.858597	06	1	.862787	06
2	.845842	12	2	.850156	12	2	.854427	12	2	.858657	12	2	.862847	12
3	.845904	19	3	.850217	18	3	.854488	18	3	.858718	18	3	.862906	18
4	.845966	25	4	.850279	25	4	.854549	24	4	.858778	24	4	.862966	24
5	.846028	31	5	.850340	31	5	.854610	30	5	.858838	30	5	.863025	30
6	.846090	37	6	.850401	37	6	.854670	36	6	.858898	36	6	.863085	36
7	.846151	43	7	.850462	43	7	.854731	42	7	.858958	42	7	.863144	42
8	.846213	50	8	.850524	49	8	.854792	48	8	.859018	48	8	.863204	48
9	.846275	56	9	.850585	55	9	.854852	54	9	.859078	54	9	.863263	54

Log. .863323 to .883605

No. 7300 to 7649.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
7300	.863323	00	7370	.867467	00	7440	.871573	00	7510	.875640	00	7580	.879669	00
1	.863382	06	1	.867526	06	1	.871631	06	1	.875698	06	1	.879726	06
2	.863442	12	2	.867585	12	2	.871690	12	2	.875756	12	2	.879784	11
3	.863501	18	3	.867644	18	3	.871748	18	3	.875813	17	3	.879841	17
4	.863561	24	4	.867703	24	4	.871806	23	4	.875871	23	4	.879898	23
5	.863620	30	5	.867762	29	5	.871865	29	5	.875929	29	5	.879956	28
6	.863680	36	6	.867821	35	6	.871923	35	6	.875987	35	6	.880013	34
7	.863739	42	7	.867880	41	7	.871981	41	7	.876045	41	7	.880070	40
8	.863798	48	8	.867939	47	8	.872040	47	8	.876102	46	8	.880127	46
9	.863858	54	9	.867997	53	9	.872098	53	9	.876160	52	9	.880185	51
7310	.863917	00	7380	.868056	00	7450	.872156	00	7520	.876218	00	7590	.880242	00
1	.863977	06	1	.868115	06	1	.872215	06	1	.876276	06	1	.880299	06
2	.864036	12	2	.868174	12	2	.872273	12	2	.876333	12	2	.880356	11
3	.864096	18	3	.868233	18	3	.872331	18	3	.876391	17	3	.880413	17
4	.864155	24	4	.868292	24	4	.872389	23	4	.876449	23	4	.880471	23
5	.864214	30	5	.868350	29	5	.872448	29	5	.876506	29	5	.880528	28
6	.864274	36	6	.868409	35	6	.872506	35	6	.876564	34	6	.880585	34
7	.864333	42	7	.868468	41	7	.872564	41	7	.876622	40	7	.880642	40
8	.864392	48	8	.868527	47	8	.872622	47	8	.876680	46	8	.880699	46
9	.864452	54	9	.868586	53	9	.872681	53	9	.876737	52	9	.880756	51
7320	.864511	00	7390	.868644	00	7460	.872739	00	7530	.876795	00	7600	.880814	00
1	.864570	06	1	.868703	06	1	.872797	06	1	.876853	06	1	.880871	06
2	.864630	12	2	.868762	12	2	.872855	12	2	.876910	12	2	.880928	11
3	.864689	18	3	.868821	18	3	.872913	18	3	.876968	17	3	.880985	17
4	.864748	24	4	.868879	24	4	.872972	23	4	.877026	23	4	.881042	23
5	.864808	30	5	.868938	29	5	.873030	29	5	.877083	29	5	.881099	28
6	.864867	36	6	.868997	35	6	.873088	35	6	.877141	34	6	.881156	34
7	.864926	42	7	.869056	41	7	.873146	41	7	.877198	40	7	.881213	40
8	.864985	48	8	.869114	47	8	.873204	47	8	.877256	46	8	.881270	46
9	.865045	54	9	.869173	53	9	.873262	53	9	.877314	52	9	.881328	51
7330	.865104	00	7400	.869232	00	7470	.873321	00	7540	.877371	00	7610	.881385	00
1	.865163	06	1	.869290	06	1	.873379	06	1	.877429	06	1	.881442	06
2	.865222	12	2	.869349	12	2	.873437	12	2	.877486	12	2	.881499	11
3	.865282	18	3	.869408	18	3	.873495	18	3	.877544	17	3	.881556	17
4	.865341	24	4	.869466	24	4	.873553	23	4	.877602	23	4	.881613	23
5	.865400	30	5	.869525	29	5	.873611	29	5	.877659	29	5	.881670	28
6	.865459	36	6	.869584	35	6	.873669	35	6	.877717	34	6	.881727	34
7	.865518	42	7	.869642	41	7	.873727	41	7	.877774	40	7	.881784	40
8	.865578	48	8	.869701	47	8	.873785	47	8	.877832	46	8	.881841	46
9	.865637	54	9	.869760	53	9	.873843	53	9	.877889	52	9	.881898	51
7340	.865696	00	7410	.869818	00	7480	.873902	00	7550	.877947	00	7620	.881955	00
1	.865755	06	1	.869877	06	1	.873960	06	1	.878004	06	1	.882012	06
2	.865814	12	2	.869935	12	2	.874018	12	2	.878062	12	2	.882069	11
3	.865873	18	3	.869994	18	3	.874076	17	3	.878119	17	3	.882126	17
4	.865933	24	4	.870053	24	4	.874134	23	4	.878177	23	4	.882183	23
5	.865992	30	5	.870111	29	5	.874192	29	5	.878234	29	5	.882240	28
6	.866051	36	6	.870170	35	6	.874250	35	6	.878292	34	6	.882297	34
7	.866110	42	7	.870228	41	7	.874308	41	7	.878349	40	7	.882354	40
8	.866169	48	8	.870287	47	8	.874366	46	8	.878407	46	8	.882411	46
9	.866228	54	9	.870345	53	9	.874424	52	9	.878464	52	9	.882468	51
7350	.866287	00	7420	.870404	00	7490	.874482	00	7560	.878522	00	7630	.882524	00
1	.866346	06	1	.870462	06	1	.874540	06	1	.878579	06	1	.882581	06
2	.866405	12	2	.870521	12	2	.874598	12	2	.878637	12	2	.882638	11
3	.866465	18	3	.870579	18	3	.874656	17	3	.878694	17	3	.882695	17
4	.866524	24	4	.870638	24	4	.874714	23	4	.878751	23	4	.882752	23
5	.866583	30	5	.870696	29	5	.874772	29	5	.878809	29	5	.882809	28
6	.866642	36	6	.870755	35	6	.874830	35	6	.878866	34	6	.882866	34
7	.866701	41	7	.870813	41	7	.874887	41	7	.878924	40	7	.882923	40
8	.866760	47	8	.870872	47	8	.874945	46	8	.878981	46	8	.882980	46
9	.866819	53	9	.870930	53	9	.875003	52	9	.879038	52	9	.883036	51
7360	.866878	00	7430	.870989	00	7500	.875061	00	7570	.879096	00	7640	.883093	00
1	.866937	06	1	.871047	06	1	.875119	06	1	.879153	06	1	.883150	06
2	.866996	12	2	.871106	12	2	.875177	12	2	.879211	12	2	.883207	11
3	.867055	18	3	.871164	18	3	.875235	17	3	.879268	17	3	.883264	17
4	.867114	24	4	.871223	24	4	.875293	23	4	.879325	23	4	.883321	23
5	.867173	29	5	.871281	29	5	.875351	29	5	.879383	29	5	.883377	28
6	.867232	35	6	.871339	35	6	.875409	35	6	.879440	34	6	.883434	34
7	.867291	41	7	.871398	41	7	.875466	41	7	.879497	40	7	.883491	40
8	.867350	47	8	.871456	47	8	.875524	46	8	.879555	46	8	.883548	46
9	.867409	53	9	.871515	53	9	.875582	52	9	.879612	52	9	.883605	51

Log. .883661 to .903036

No. 7650 to 7999.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
7650	.883661	00	7720	.887617	00	7790	.891537	00	7860	.895422	00	7930	.899273	00
1	.883718	06	1	.887674	06	1	.891593	06	1	.895478	06	1	.899328	05
2	.883775	11	2	.887730	11	2	.891649	11	2	.895533	11	2	.899383	11
3	.883832	17	3	.887786	17	3	.891705	17	3	.895588	17	3	.899437	17
4	.883888	23	4	.887842	23	4	.891760	22	4	.895643	22	4	.899492	22
5	.883945	28	5	.887898	28	5	.891816	28	5	.895699	27	5	.899547	27
6	.884002	34	6	.887955	34	6	.891872	33	6	.895754	33	6	.899602	33
7	.884059	40	7	.888011	39	7	.891927	39	7	.895809	39	7	.899656	38
8	.884115	46	8	.888067	45	8	.891983	44	8	.895864	44	8	.899711	44
9	.884172	51	9	.888123	51	9	.892039	50	9	.895919	50	9	.899766	50
7660	.884229	00	7730	.888179	00	7800	.892095	00	7870	.895975	00	7940	.899820	00
1	.884285	06	1	.888236	06	1	.892150	06	1	.896030	06	1	.899875	05
2	.884342	11	2	.888292	11	2	.892206	11	2	.896085	11	2	.899930	11
3	.884399	17	3	.888348	17	3	.892262	17	3	.896140	17	3	.899985	17
4	.884455	23	4	.888404	22	4	.892317	22	4	.896195	22	4	.900039	22
5	.884512	28	5	.888460	28	5	.892373	28	5	.896251	27	5	.900094	27
6	.884569	34	6	.888516	34	6	.892428	33	6	.896306	33	6	.900149	33
7	.884625	40	7	.888573	39	7	.892484	39	7	.896361	39	7	.900203	38
8	.884682	46	8	.888629	45	8	.892540	44	8	.896416	44	8	.900258	44
9	.884739	51	9	.888685	50	9	.892595	50	9	.896471	50	9	.900312	50
7670	.884795	00	7740	.888741	00	7810	.892651	00	7880	.896526	00	7950	.900367	00
1	.884852	06	1	.888797	06	1	.892707	06	1	.896581	06	1	.900422	05
2	.884909	11	2	.888853	11	2	.892762	11	2	.896636	11	2	.900476	11
3	.884965	17	3	.888909	17	3	.892818	17	3	.896691	17	3	.900531	17
4	.885022	23	4	.888965	22	4	.892873	22	4	.896747	22	4	.900586	22
5	.885078	28	5	.889021	28	5	.892929	28	5	.896802	27	5	.900640	27
6	.885135	34	6	.889077	34	6	.892985	33	6	.896857	33	6	.900695	33
7	.885191	40	7	.889134	39	7	.893040	39	7	.896912	39	7	.900749	38
8	.885248	46	8	.889190	45	8	.893096	44	8	.896967	44	8	.900804	44
9	.885305	51	9	.889246	50	9	.893151	50	9	.897022	50	9	.900858	50
7680	.885361	00	7750	.889302	00	7820	.893207	00	7890	.897077	00	7960	.900913	00
1	.885418	06	1	.889358	06	1	.893262	06	1	.897132	06	1	.900968	05
2	.885474	11	2	.889414	11	2	.893318	11	2	.897187	11	2	.901022	11
3	.885531	17	3	.889470	17	3	.893373	17	3	.897242	17	3	.901077	16
4	.885587	23	4	.889526	22	4	.893429	22	4	.897297	22	4	.901131	22
5	.885644	28	5	.889582	28	5	.893484	28	5	.897352	27	5	.901186	27
6	.885700	34	6	.889638	34	6	.893540	33	6	.897407	33	6	.901240	33
7	.885757	39	7	.889694	39	7	.893595	39	7	.897462	39	7	.901295	38
8	.885813	45	8	.889750	45	8	.893651	44	8	.897517	44	8	.901349	44
9	.885870	51	9	.889806	50	9	.893706	50	9	.897572	50	9	.901404	49
7690	.885926	00	7760	.889862	00	7830	.893762	00	7900	.897627	00	7970	.901458	00
1	.885983	06	1	.889918	06	1	.893817	06	1	.897682	06	1	.901513	05
2	.886039	11	2	.889974	11	2	.893873	11	2	.897737	11	2	.901567	11
3	.886096	17	3	.890030	17	3	.893928	17	3	.897792	17	3	.901622	16
4	.886152	23	4	.890085	22	4	.893984	22	4	.897847	22	4	.901676	22
5	.886209	28	5	.890141	28	5	.894039	28	5	.897902	27	5	.901731	27
6	.886265	34	6	.890197	34	6	.894094	33	6	.897957	33	6	.901785	33
7	.886321	39	7	.890253	39	7	.894150	39	7	.898012	39	7	.901840	38
8	.886378	45	8	.890309	45	8	.894205	44	8	.898067	44	8	.901894	44
9	.886434	51	9	.890365	50	9	.894261	50	9	.898122	50	9	.901948	49
7700	.886491	00	7770	.890421	00	7840	.894316	00	7910	.898176	00	7980	.902003	00
1	.886547	06	1	.890477	06	1	.894371	06	1	.898231	06	1	.902057	05
2	.886603	11	2	.890533	11	2	.894427	11	2	.898286	11	2	.902112	11
3	.886660	17	3	.890589	17	3	.894482	17	3	.898341	17	3	.902166	16
4	.886716	23	4	.890644	22	4	.894538	22	4	.898396	22	4	.902220	22
5	.886773	28	5	.890700	28	5	.894593	27	5	.898451	27	5	.902275	27
6	.886829	34	6	.890756	34	6	.894648	33	6	.898506	33	6	.902329	33
7	.886885	39	7	.890812	39	7	.894704	39	7	.898561	39	7	.902384	38
8	.886942	45	8	.890868	45	8	.894759	44	8	.898615	44	8	.902438	44
9	.886998	51	9	.890924	50	9	.894814	50	9	.898670	50	9	.902492	49
7710	.887054	00	7780	.890980	00	7850	.894870	00	7920	.898725	00	7990	.902547	00
1	.887111	06	1	.891035	06	1	.894925	06	1	.898780	05	1	.902601	05
2	.887167	11	2	.891091	11	2	.894980	11	2	.898835	11	2	.902655	11
3	.887223	17	3	.891147	17	3	.895036	17	3	.898890	17	3	.902710	16
4	.887280	23	4	.891203	22	4	.895091	22	4	.898944	22	4	.902764	22
5	.887336	28	5	.891259	28	5	.895146	27	5	.898999	27	5	.902818	27
6	.887392	34	6	.891314	34	6	.895201	33	6	.899054	33	6	.902873	33
7	.887448	39	7	.891370	39	7	.895257	39	7	.899109	38	7	.902927	38
8	.887505	45	8	.891426	45	8	.895312	44	8	.899164	44	8	.902981	44
9	.887561	51	9	.891482	50	9	.895367	50	9	.899218	50	9	.903036	49

Log. .903090 to .921634

No. 8000 to 8349.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
8000	.903090	00	8070	.906873	00	8140	.910624	00	8210	.914343	00	8280	.918030	00
1	.903144	05	1	.906927	05	1	.910678	05	1	.914396	05	1	.918083	05
2	.903198	11	2	.906981	11	2	.910731	11	2	.914449	11	2	.918135	11
3	.903253	16	3	.907035	16	3	.910784	16	3	.914502	16	3	.918188	16
4	.903307	22	4	.907089	22	4	.910838	21	4	.914555	21	4	.918240	21
5	.903361	27	5	.907142	27	5	.910891	27	5	.914608	27	5	.918292	26
6	.903416	32	6	.907196	32	6	.910944	32	6	.914660	32	6	.918345	31
7	.903470	38	7	.907250	38	7	.910998	37	7	.914713	37	7	.918397	37
8	.903524	43	8	.907304	43	8	.911051	43	8	.914766	42	8	.918450	42
9	.903578	49	9	.907358	49	9	.911104	48	9	.914819	48	9	.918502	47
8010	.903632	00	8080	.907411	00	8150	.911158	00	8220	.914872	00	8290	.918554	00
1	.903687	05	1	.907465	05	1	.911211	05	1	.914925	05	1	.918607	05
2	.903741	11	2	.907519	11	2	.911264	11	2	.914977	11	2	.918659	11
3	.903795	16	3	.907573	16	3	.911317	16	3	.915030	16	3	.918712	16
4	.903849	22	4	.907626	22	4	.911371	21	4	.915083	21	4	.918764	21
5	.903903	27	5	.907680	27	5	.911424	27	5	.915136	27	5	.918816	26
6	.903958	32	6	.907734	32	6	.911477	32	6	.915189	32	6	.918869	31
7	.904012	38	7	.907787	38	7	.911530	37	7	.915241	37	7	.918921	37
8	.904066	43	8	.907841	43	8	.911584	42	8	.915294	42	8	.918973	42
9	.904120	49	9	.907895	49	9	.911637	48	9	.915347	48	9	.919026	47
8020	.904174	00	8090	.907948	00	8160	.911690	00	8230	.915400	00	8300	.919078	00
1	.904228	05	1	.908002	05	1	.911743	05	1	.915453	05	1	.919130	05
2	.904283	11	2	.908056	11	2	.911797	11	2	.915505	11	2	.919183	11
3	.904337	16	3	.908109	16	3	.911850	16	3	.915558	16	3	.919235	16
4	.904391	22	4	.908163	22	4	.911903	21	4	.915611	21	4	.919287	21
5	.904445	27	5	.908217	27	5	.911956	27	5	.915664	27	5	.919340	26
6	.904499	32	6	.908270	32	6	.912009	32	6	.915716	32	6	.919392	31
7	.904553	38	7	.908324	38	7	.912063	37	7	.915769	37	7	.919444	37
8	.904607	43	8	.908378	43	8	.912116	42	8	.915822	42	8	.919496	42
9	.904661	49	9	.908431	49	9	.912169	48	9	.915874	48	9	.919549	47
8030	.904715	00	8100	.908485	00	8170	.912222	00	8240	.915927	00	8310	.919601	00
1	.904770	05	1	.908539	05	1	.912275	05	1	.915980	05	1	.919653	05
2	.904824	11	2	.908592	11	2	.912328	11	2	.916033	11	2	.919705	11
3	.904878	16	3	.908646	16	3	.912381	16	3	.916085	16	3	.919758	16
4	.904932	22	4	.908699	21	4	.912435	21	4	.916138	21	4	.919810	21
5	.904986	27	5	.908753	27	5	.912488	27	5	.916191	27	5	.919862	26
6	.905040	32	6	.908807	32	6	.912541	32	6	.916243	32	6	.919914	31
7	.905094	38	7	.908860	37	7	.912594	37	7	.916296	37	7	.919967	37
8	.905148	43	8	.908914	43	8	.912647	42	8	.916349	42	8	.920019	42
9	.905202	49	9	.908967	48	9	.912700	48	9	.916401	48	9	.920071	47
8040	.905256	00	8110	.909021	00	8180	.912753	00	8250	.916454	00	8320	.920123	00
1	.905310	05	1	.909074	05	1	.912806	05	1	.916507	05	1	.920175	05
2	.905364	11	2	.909128	11	2	.912859	11	2	.916559	11	2	.920228	10
3	.905418	16	3	.909181	16	3	.912913	16	3	.916612	16	3	.920280	16
4	.905472	22	4	.909235	21	4	.912966	21	4	.916664	21	4	.920332	21
5	.905526	27	5	.909288	27	5	.913019	27	5	.916717	26	5	.920384	26
6	.905580	32	6	.909342	32	6	.913072	32	6	.916770	31	6	.920436	31
7	.905634	38	7	.909395	37	7	.913125	37	7	.916822	37	7	.920489	36
8	.905688	43	8	.909449	43	8	.913178	42	8	.916875	42	8	.920541	42
9	.905742	49	9	.909502	48	9	.913231	48	9	.916927	47	9	.920593	47
8050	.905796	00	8120	.909556	00	8190	.913284	00	8260	.916980	00	8330	.920645	00
1	.905850	05	1	.909609	05	1	.913337	05	1	.917033	05	1	.920697	05
2	.905904	11	2	.909663	11	2	.913390	11	2	.917085	11	2	.920749	10
3	.905958	16	3	.909716	16	3	.913443	16	3	.917138	16	3	.920801	16
4	.906012	22	4	.909770	21	4	.913496	21	4	.917190	21	4	.920853	21
5	.906065	27	5	.909823	27	5	.913549	27	5	.917243	26	5	.920906	26
6	.906119	32	6	.909877	32	6	.913602	32	6	.917295	31	6	.920958	31
7	.906173	38	7	.909930	37	7	.913655	37	7	.917348	37	7	.921010	36
8	.906227	43	8	.909984	43	8	.913708	42	8	.917400	42	8	.921062	42
9	.906281	49	9	.910037	48	9	.913761	48	9	.917453	47	9	.921114	47
8060	.906335	00	8130	.910090	00	8200	.913814	00	8270	.917505	00	8340	.921166	00
1	.906389	05	1	.910144	05	1	.913867	05	1	.917558	05	1	.921218	05
2	.906443	11	2	.910197	11	2	.913920	11	2	.917610	11	2	.921270	10
3	.906497	16	3	.910251	16	3	.913973	16	3	.917663	16	3	.921322	16
4	.906550	22	4	.910304	21	4	.914026	21	4	.917715	21	4	.921374	21
5	.906604	27	5	.910358	27	5	.914079	27	5	.917768	26	5	.921426	26
6	.906658	32	6	.910411	32	6	.914131	32	6	.917820	31	6	.921478	31
7	.906712	38	7	.910464	37	7	.914184	37	7	.917873	37	7	.921530	36
8	.906766	43	8	.910518	43	8	.914237	42	8	.917925	42	8	.921582	42
9	.906820	49	9	.910571	48	9	.914290	48	9	.917978	47	9	.921634	47

Log. .921686 to .939469

No. 8350 to 8699.

(u.)

No.	Log.	Part	No.	Log.	Part	No.	Log.	Part	No.	Log.	Part	No.	Log.	Part
8350	.921686	00	8420	.925312	00	8490	.928908	00	8560	.932474	00	8630	.936011	00
1	.921738	05	1	.925364	05	1	.928959	05	1	.932524	05	1	.936061	05
2	.921790	10	2	.925415	10	2	.929010	10	2	.932575	10	2	.936111	10
3	.921842	16	3	.925467	15	3	.929061	15	3	.932626	15	3	.936162	15
4	.921894	21	4	.925518	21	4	.929112	20	4	.932677	20	4	.936212	20
5	.921946	26	5	.925570	26	5	.929163	26	5	.932727	25	5	.936262	25
6	.921998	31	6	.925621	31	6	.929214	31	6	.932778	30	6	.936313	30
7	.922050	36	7	.925673	36	7	.929266	36	7	.932829	35	7	.936363	35
8	.922102	42	8	.925724	41	8	.929317	41	8	.932879	40	8	.936413	40
9	.922154	47	9	.925776	46	9	.929368	46	9	.932930	45	9	.936463	45
8360	.922206	00	8430	.925828	00	8500	.929419	00	8570	.932981	00	8640	.936514	00
1	.922258	05	1	.925879	05	1	.929470	05	1	.933031	05	1	.936564	05
2	.922310	10	2	.925931	10	2	.929521	10	2	.933082	10	2	.936614	10
3	.922362	16	3	.925982	15	3	.929572	15	3	.933133	15	3	.936664	15
4	.922414	21	4	.926034	21	4	.929623	20	4	.933183	20	4	.936715	20
5	.922466	26	5	.926085	26	5	.929674	26	5	.933234	25	5	.936765	25
6	.922518	31	6	.926137	31	6	.929725	31	6	.933285	30	6	.936815	30
7	.922570	36	7	.926188	36	7	.929776	36	7	.933335	35	7	.936865	35
8	.922622	42	8	.926239	41	8	.929827	41	8	.933386	40	8	.936916	40
9	.922674	47	9	.926291	46	9	.929878	46	9	.933437	45	9	.936966	45
8370	.922725	00	8440	.926342	00	8510	.929930	00	8580	.933487	00	8650	.937016	00
1	.922777	05	1	.926394	05	1	.929981	05	1	.933538	05	1	.937066	05
2	.922829	10	2	.926445	10	2	.930032	10	2	.933588	10	2	.937116	10
3	.922881	16	3	.926497	15	3	.930083	15	3	.933639	15	3	.937167	15
4	.922933	21	4	.926548	21	4	.930134	20	4	.933690	20	4	.937217	20
5	.922985	26	5	.926600	26	5	.930185	26	5	.933740	25	5	.937267	25
6	.923037	31	6	.926651	31	6	.930236	31	6	.933791	30	6	.937317	30
7	.923088	36	7	.926702	36	7	.930287	36	7	.933841	35	7	.937367	35
8	.923140	42	8	.926754	41	8	.930338	41	8	.933892	40	8	.937418	40
9	.923192	47	9	.926805	46	9	.930389	46	9	.933943	45	9	.937468	45
8380	.923244	00	8450	.926857	00	8520	.930440	00	8590	.933993	00	8660	.937518	00
1	.923296	05	1	.926908	05	1	.930491	05	1	.934044	05	1	.937568	05
2	.923348	10	2	.926959	10	2	.930541	10	2	.934094	10	2	.937618	10
3	.923399	16	3	.927011	15	3	.930592	15	3	.934145	15	3	.937668	15
4	.923451	21	4	.927062	21	4	.930643	20	4	.934195	20	4	.937718	20
5	.923503	26	5	.927114	26	5	.930694	25	5	.934246	25	5	.937769	25
6	.923555	31	6	.927165	31	6	.930745	31	6	.934296	30	6	.937819	30
7	.923607	36	7	.927216	36	7	.930796	36	7	.934347	35	7	.937869	35
8	.923658	42	8	.927268	41	8	.930847	41	8	.934397	40	8	.937919	40
9	.923710	47	9	.927319	46	9	.930898	46	9	.934448	45	9	.937969	45
8390	.923762	00	8460	.927370	00	8530	.930949	00	8600	.934498	00	8670	.938019	00
1	.923814	05	1	.927422	05	1	.931000	05	1	.934549	05	1	.938069	05
2	.923865	10	2	.927473	10	2	.931051	10	2	.934599	10	2	.938119	10
3	.923917	16	3	.927524	15	3	.931102	15	3	.934650	15	3	.938169	15
4	.923969	21	4	.927576	21	4	.931153	20	4	.934700	20	4	.938219	20
5	.924021	26	5	.927627	26	5	.931203	25	5	.934751	25	5	.938269	25
6	.924072	31	6	.927678	31	6	.931254	31	6	.934801	30	6	.938319	30
7	.924124	36	7	.927730	36	7	.931305	36	7	.934852	35	7	.938370	35
8	.924176	42	8	.927781	41	8	.931356	41	8	.934902	40	8	.938420	40
9	.924228	47	9	.927832	46	9	.931407	46	9	.934953	45	9	.938470	45
8400	.924279	00	8470	.927883	00	8540	.931458	00	8610	.935003	00	8680	.938520	00
1	.924331	05	1	.927935	05	1	.931509	05	1	.935054	05	1	.938570	05
2	.924383	10	2	.927986	10	2	.931560	10	2	.935104	10	2	.938620	10
3	.924434	15	3	.928037	15	3	.931610	15	3	.935154	15	3	.938670	15
4	.924486	21	4	.928088	21	4	.931661	20	4	.935205	20	4	.938720	20
5	.924538	26	5	.928140	26	5	.931712	25	5	.935255	25	5	.938770	25
6	.924589	31	6	.928191	31	6	.931763	31	6	.935306	30	6	.938820	30
7	.924641	36	7	.928242	36	7	.931814	36	7	.935356	35	7	.938870	35
8	.924693	41	8	.928293	41	8	.931864	41	8	.935406	40	8	.938920	40
9	.924744	46	9	.928345	46	9	.931915	46	9	.935457	45	9	.938970	45
8410	.924796	00	8480	.928396	00	8550	.931966	00	8620	.935507	00	8690	.939020	00
1	.924848	05	1	.928447	05	1	.932017	05	1	.935558	05	1	.939070	05
2	.924899	10	2	.928498	10	2	.932068	10	2	.935608	10	2	.939120	10
3	.924951	15	3	.928549	15	3	.932118	15	3	.935658	15	3	.939170	15
4	.925002	21	4	.928601	21	4	.932169	20	4	.935709	20	4	.939220	20
5	.925054	26	5	.928652	26	5	.932220	25	5	.935759	25	5	.939270	25
6	.925106	31	6	.928703	31	6	.932271	30	6	.935809	30	6	.939319	30
7	.925157	36	7	.928754	36	7	.932321	35	7	.935860	35	7	.939369	35
8	.925209	41	8	.928805	41	8	.932372	40	8	.935910	40	8	.939419	40
9	.925260	46	9	.928856	46	9	.932423	45	9	.935960	45	9	.939469	45

Log. .939519 to .956601

No. 8700 to 9049.

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No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
8700	.939519	00	8770	.943000	00	8840	.946452	00	8910	.949878	00	8980	.953276	00
1	.939569	05	1	.943049	05	1	.946501	05	1	.949926	05	1	.953325	05
2	.939619	10	2	.943099	10	2	.946550	10	2	.949975	10	2	.953373	10
3	.939669	15	3	.943148	15	3	.946600	15	3	.950024	15	3	.953421	15
4	.939719	20	4	.943198	20	4	.946649	20	4	.950073	20	4	.953470	19
5	.939769	25	5	.943247	25	5	.946698	25	5	.950121	25	5	.953518	24
6	.939819	30	6	.943297	30	6	.946747	29	6	.950170	29	6	.953566	29
7	.939868	35	7	.943346	35	7	.946796	34	7	.950219	34	7	.953615	34
8	.939918	40	8	.943396	40	8	.946845	39	8	.950267	39	8	.953663	39
9	.939968	45	9	.943445	45	9	.946894	44	9	.950316	44	9	.953711	44
8710	.940018	00	8780	.943494	00	8850	.946943	00	8920	.950365	00	8990	.953760	00
1	.940068	05	1	.943544	05	1	.946992	05	1	.950413	05	1	.953808	05
2	.940118	10	2	.943593	10	2	.947041	10	2	.950462	10	2	.953856	10
3	.940168	15	3	.943643	15	3	.947090	15	3	.950511	15	3	.953905	15
4	.940218	20	4	.943692	20	4	.947139	20	4	.950560	19	4	.953953	19
5	.940267	25	5	.943742	25	5	.947189	25	5	.950608	24	5	.954001	24
6	.940317	30	6	.943791	30	6	.947238	29	6	.950657	29	6	.954049	29
7	.940367	35	7	.943841	35	7	.947287	34	7	.950705	34	7	.954098	34
8	.940417	40	8	.943890	40	8	.947336	39	8	.950754	39	8	.954146	39
9	.940467	45	9	.943939	45	9	.947385	44	9	.950803	44	9	.954194	44
8720	.940516	00	8790	.943989	00	8860	.947434	00	8930	.950851	00	9000	.954242	00
1	.940566	05	1	.944038	05	1	.947483	05	1	.950900	05	1	.954291	05
2	.940616	10	2	.944088	10	2	.947532	10	2	.950949	10	2	.954339	10
3	.940666	15	3	.944137	15	3	.947581	15	3	.950997	15	3	.954387	14
4	.940716	20	4	.944186	20	4	.947630	20	4	.951046	19	4	.954435	19
5	.940765	25	5	.944236	25	5	.947679	25	5	.951095	24	5	.954484	24
6	.940815	30	6	.944285	30	6	.947728	29	6	.951143	29	6	.954532	29
7	.940865	35	7	.944335	35	7	.947777	34	7	.951192	34	7	.954580	34
8	.940915	40	8	.944384	40	8	.947826	39	8	.951240	39	8	.954628	38
9	.940964	45	9	.944433	45	9	.947875	44	9	.951289	44	9	.954677	43
8730	.941014	00	8800	.944483	00	8870	.947924	00	8940	.951337	00	9010	.954725	00
1	.941064	05	1	.944532	05	1	.947973	05	1	.951386	05	1	.954773	05
2	.941114	10	2	.944581	10	2	.948021	10	2	.951435	10	2	.954821	10
3	.941163	15	3	.944631	15	3	.948070	15	3	.951483	15	3	.954869	14
4	.941213	20	4	.944680	20	4	.948119	20	4	.951532	19	4	.954918	19
5	.941263	25	5	.944729	25	5	.948168	25	5	.951580	24	5	.954966	24
6	.941313	30	6	.944779	30	6	.948217	29	6	.951629	29	6	.955014	29
7	.941362	35	7	.944828	35	7	.948266	34	7	.951677	34	7	.955062	34
8	.941412	40	8	.944877	40	8	.948315	39	8	.951726	39	8	.955110	38
9	.941462	45	9	.944927	45	9	.948364	44	9	.951774	44	9	.955158	43
8740	.941511	00	8810	.944976	00	8880	.948413	00	8950	.951823	00	9020	.955206	00
1	.941561	05	1	.945025	05	1	.948462	05	1	.951872	05	1	.955255	05
2	.941611	10	2	.945074	10	2	.948511	10	2	.951920	10	2	.955303	10
3	.941660	15	3	.945124	15	3	.948560	15	3	.951969	15	3	.955351	14
4	.941710	20	4	.945173	20	4	.948608	20	4	.952017	19	4	.955399	19
5	.941760	25	5	.945222	25	5	.948657	25	5	.952066	24	5	.955447	24
6	.941809	30	6	.945272	30	6	.948706	29	6	.952114	29	6	.955495	29
7	.941859	35	7	.945321	35	7	.948755	34	7	.952163	34	7	.955543	34
8	.941909	40	8	.945370	40	8	.948804	39	8	.952211	39	8	.955592	38
9	.941958	45	9	.945419	45	9	.948853	44	9	.952259	44	9	.955640	43
8750	.942008	00	8820	.945469	00	8890	.948902	00	8960	.952308	00	9030	.955688	00
1	.942058	05	1	.945518	05	1	.948951	05	1	.952356	05	1	.955736	05
2	.942107	10	2	.945567	10	2	.948999	10	2	.952405	10	2	.955784	10
3	.942157	15	3	.945616	15	3	.949048	15	3	.952453	15	3	.955832	14
4	.942206	20	4	.945665	20	4	.949097	20	4	.952502	19	4	.955880	19
5	.942256	25	5	.945715	25	5	.949146	25	5	.952550	24	5	.955928	24
6	.942306	30	6	.945764	29	6	.949195	29	6	.952599	29	6	.955976	29
7	.942355	35	7	.945813	34	7	.949244	34	7	.952647	34	7	.956024	34
8	.942405	40	8	.945862	39	8	.949292	39	8	.952696	39	8	.956072	38
9	.942454	45	9	.945911	44	9	.949341	44	9	.952744	44	9	.956120	43
8760	.942504	00	8830	.945961	00	8900	.949390	00	8970	.952792	00	9040	.956168	00
1	.942554	05	1	.946010	05	1	.949439	05	1	.952841	05	1	.956216	05
2	.942603	10	2	.946059	10	2	.949488	10	2	.952889	10	2	.956264	10
3	.942653	15	3	.946108	15	3	.949536	15	3	.952938	15	3	.956312	14
4	.942702	20	4	.946157	20	4	.949585	20	4	.952986	19	4	.956361	19
5	.942752	25	5	.946207	25	5	.949634	25	5	.953034	24	5	.956409	24
6	.942801	30	6	.946256	29	6	.949683	29	6	.953083	29	6	.956457	29
7	.942851	35	7	.946305	34	7	.949731	34	7	.953131	34	7	.956505	34
8	.942900	40	8	.946354	39	8	.949780	39	8	.953180	39	8	.956553	38
9	.942950	45	9	.946403	44	9	.949829	44	9	.953228	44	9	.956601	43

Log. .956649 to .973082

No. 9050 to 9399

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
9050	.956649	00	9120	.959995	00	9190	.963315	00	9260	.966611	00	9330	.969882	00
1	.956697	05	1	.960042	05	1	.963363	05	1	.966658	05	1	.969928	05
2	.956744	10	2	.960090	10	2	.963410	09	2	.966705	09	2	.969975	09
3	.956792	14	3	.960138	14	3	.963457	14	3	.966752	14	3	.970021	14
4	.956840	19	4	.960185	19	4	.963504	19	4	.966798	19	4	.970068	19
5	.956888	24	5	.960233	24	5	.963552	24	5	.966845	24	5	.970114	23
6	.956936	29	6	.960280	28	6	.963599	28	6	.966892	28	6	.970161	28
7	.956984	34	7	.960328	33	7	.963646	33	7	.966939	33	7	.970207	33
8	.957032	38	8	.960376	38	8	.963693	38	8	.966986	38	8	.970254	37
9	.957080	43	9	.960423	43	9	.963741	42	9	.967033	42	9	.970300	42
9060	.957128	00	9130	.960471	00	9200	.963788	00	9270	.967080	00	9340	.970347	00
1	.957176	05	1	.960518	05	1	.963835	05	1	.967127	05	1	.970393	05
2	.957224	10	2	.960566	10	2	.963882	09	2	.967173	09	2	.970440	09
3	.957272	14	3	.960613	14	3	.963929	14	3	.967220	14	3	.970486	14
4	.957320	19	4	.960661	19	4	.963977	19	4	.967267	19	4	.970533	19
5	.957368	24	5	.960709	24	5	.964024	24	5	.967314	24	5	.970579	23
6	.957416	29	6	.960756	28	6	.964071	28	6	.967361	28	6	.970626	28
7	.957464	34	7	.960804	33	7	.964118	33	7	.967408	33	7	.970672	33
8	.957511	38	8	.960851	38	8	.964165	38	8	.967454	38	8	.970719	37
9	.957559	43	9	.960899	43	9	.964212	42	9	.967501	42	9	.970765	42
9070	.957607	00	9140	.960946	00	9210	.964260	00	9280	.967548	00	9350	.970812	00
1	.957655	05	1	.960994	05	1	.964307	05	1	.967595	05	1	.970858	05
2	.957703	10	2	.961041	10	2	.964354	09	2	.967642	09	2	.970904	09
3	.957751	14	3	.961089	14	3	.964401	14	3	.967688	14	3	.970951	14
4	.957799	19	4	.961136	19	4	.964448	19	4	.967735	19	4	.970997	19
5	.957847	24	5	.961184	24	5	.964495	24	5	.967782	23	5	.971044	23
6	.957894	29	6	.961231	28	6	.964542	28	6	.967829	28	6	.971090	28
7	.957942	34	7	.961279	33	7	.964590	33	7	.967875	33	7	.971137	33
8	.957990	38	8	.961326	38	8	.964637	38	8	.967922	38	8	.971183	37
9	.958038	43	9	.961374	43	9	.964684	42	9	.967969	42	9	.971229	42
9080	.958086	00	9150	.961421	00	9220	.964731	00	9290	.968016	00	9360	.971276	00
1	.958134	05	1	.961469	05	1	.964778	05	1	.968062	05	1	.971322	05
2	.958181	10	2	.961516	10	2	.964825	09	2	.968109	09	2	.971369	09
3	.958229	14	3	.961563	14	3	.964872	14	3	.968156	14	3	.971415	14
4	.958277	19	4	.961611	19	4	.964919	19	4	.968203	19	4	.971461	19
5	.958325	24	5	.961658	24	5	.964966	24	5	.968249	23	5	.971508	23
6	.958373	29	6	.961706	28	6	.965013	28	6	.968296	28	6	.971554	28
7	.958420	34	7	.961753	33	7	.965060	33	7	.968343	33	7	.971600	33
8	.958468	38	8	.961801	38	8	.965108	38	8	.968389	38	8	.971647	37
9	.958516	43	9	.961848	43	9	.965155	42	9	.968436	42	9	.971693	42
9090	.958564	00	9160	.961895	00	9230	.965202	00	9300	.968483	00	9370	.971740	00
1	.958612	05	1	.961943	05	1	.965249	05	1	.968530	05	1	.971786	05
2	.958659	10	2	.961990	10	2	.965296	09	2	.968576	09	2	.971832	09
3	.958707	14	3	.962038	14	3	.965343	14	3	.968623	14	3	.971879	14
4	.958755	19	4	.962085	19	4	.965390	19	4	.968670	19	4	.971925	19
5	.958803	24	5	.962132	24	5	.965437	24	5	.968716	23	5	.971971	23
6	.958850	29	6	.962180	28	6	.965484	28	6	.968763	28	6	.972018	28
7	.958898	34	7	.962227	33	7	.965531	33	7	.968810	33	7	.972064	33
8	.958946	38	8	.962275	38	8	.965578	38	8	.968856	37	8	.972110	37
9	.958994	43	9	.962322	43	9	.965625	42	9	.968903	42	9	.972156	42
9100	.959041	00	9170	.962369	00	9240	.965672	00	9310	.968950	00	9380	.972203	00
1	.959089	05	1	.962417	05	1	.965719	05	1	.968996	05	1	.972249	05
2	.959137	10	2	.962464	09	2	.965766	09	2	.969043	09	2	.972295	09
3	.959184	14	3	.962511	14	3	.965813	14	3	.969090	14	3	.972342	14
4	.959232	19	4	.962559	19	4	.965860	19	4	.969136	19	4	.972388	18
5	.959280	24	5	.962606	24	5	.965907	24	5	.969183	23	5	.972434	23
6	.959328	29	6	.962653	28	6	.965954	28	6	.969229	28	6	.972480	28
7	.959375	34	7	.962701	33	7	.966001	33	7	.969276	33	7	.972527	32
8	.959423	38	8	.962748	38	8	.966048	38	8	.969323	37	8	.972573	37
9	.959471	43	9	.962795	42	9	.966095	42	9	.969369	42	9	.972619	41
9110	.959518	00	9180	.962843	00	9250	.966142	00	9320	.969416	00	9390	.972666	00
1	.959566	05	1	.962890	05	1	.966189	05	1	.969462	05	1	.972712	05
2	.959614	10	2	.962937	09	2	.966236	09	2	.969509	09	2	.972758	09
3	.959661	14	3	.962985	14	3	.966283	14	3	.969556	14	3	.972804	14
4	.959709	19	4	.963032	19	4	.966329	19	4	.969602	19	4	.972851	18
5	.959757	24	5	.963079	24	5	.966376	24	5	.969649	23	5	.972897	23
6	.959804	29	6	.963126	28	6	.966423	28	6	.969695	28	6	.972943	28
7	.959852	34	7	.963174	33	7	.966470	33	7	.969742	33	7	.972989	32
8	.959900	38	8	.963221	38	8	.966517	38	8	.969788	37	8	.973035	37
9	.959947	43	9	.963268	42	9	.966564	42	9	.969835	42	9	.973082	41

Log. 973128 to .988960

No. 9400 to 9749.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
9400	.973128	00	9470	.976350	00	9540	.979548	00	9610	.982723	00	9680	.985875	00
1	.973174	05	1	.976396	05	1	.979594	05	1	.982769	05	1	.985920	04
2	.973220	09	2	.976442	09	2	.979639	09	2	.982814	09	2	.985965	09
3	.973266	14	3	.976487	14	3	.979685	14	3	.982859	14	3	.986010	13
4	.973313	18	4	.976533	18	4	.979730	18	4	.982904	18	4	.986055	18
5	.973358	23	5	.976579	23	5	.979776	23	5	.982949	23	5	.986100	22
6	.973405	28	6	.976625	28	6	.979821	27	6	.982994	27	6	.986144	27
7	.973451	32	7	.976671	32	7	.979867	32	7	.983040	32	7	.986189	31
8	.973497	37	8	.976717	37	8	.979912	36	8	.983085	36	8	.986234	36
9	.973543	41	9	.976762	41	9	.979958	41	9	.983130	41	9	.986279	40
9410	.973590	00	9480	.976808	00	9550	.980003	00	9620	.983175	00	9690	.986324	00
1	.973636	05	1	.976854	05	1	.980049	05	1	.983220	05	1	.986369	04
2	.973682	09	2	.976900	09	2	.980094	09	2	.983265	09	2	.986413	09
3	.973728	14	3	.976946	14	3	.980140	14	3	.983310	14	3	.986458	13
4	.973774	18	4	.976991	18	4	.980185	18	4	.983356	18	4	.986503	18
5	.973820	23	5	.977037	23	5	.980231	23	5	.983401	23	5	.986548	22
6	.973866	28	6	.977083	27	6	.980276	27	6	.983446	27	6	.986593	27
7	.973913	32	7	.977129	32	7	.980322	32	7	.983491	32	7	.986637	31
8	.973959	37	8	.977175	37	8	.980367	36	8	.983536	36	8	.986682	36
9	.974005	41	9	.977220	41	9	.980412	41	9	.983581	41	9	.986727	40
9420	.974051	00	9490	.977266	00	9560	.980458	00	9630	.983626	00	9700	.986772	00
1	.974097	05	1	.977312	05	1	.980503	05	1	.983671	05	1	.986816	04
2	.974143	09	2	.977358	09	2	.980549	09	2	.983716	09	2	.986861	09
3	.974189	14	3	.977403	14	3	.980594	14	3	.983762	14	3	.986906	13
4	.974235	18	4	.977449	18	4	.980640	18	4	.983807	18	4	.986951	18
5	.974281	23	5	.977495	23	5	.980685	23	5	.983852	23	5	.986995	22
6	.974327	28	6	.977541	27	6	.980730	27	6	.983897	27	6	.987040	27
7	.974373	32	7	.977586	32	7	.980776	32	7	.983942	32	7	.987085	31
8	.974420	37	8	.977632	37	8	.980821	36	8	.983987	36	8	.987130	36
9	.974466	41	9	.977678	41	9	.980867	41	9	.984032	41	9	.987174	40
9430	.974512	00	9500	.977724	00	9570	.980912	00	9640	.984077	00	9710	.987219	00
1	.974558	05	1	.977769	05	1	.980957	05	1	.984122	05	1	.987264	04
2	.974604	09	2	.977815	09	2	.981003	09	2	.984167	09	2	.987309	09
3	.974650	14	3	.977861	14	3	.981048	14	3	.984212	14	3	.987353	13
4	.974696	18	4	.977906	18	4	.981093	18	4	.984257	18	4	.987398	18
5	.974742	23	5	.977952	23	5	.981139	23	5	.984302	23	5	.987443	22
6	.974788	28	6	.977998	27	6	.981184	27	6	.984347	27	6	.987487	27
7	.974834	32	7	.978043	32	7	.981229	32	7	.984392	32	7	.987532	31
8	.974880	37	8	.978089	37	8	.981275	36	8	.984437	36	8	.987577	36
9	.974926	41	9	.978135	41	9	.981320	41	9	.984482	41	9	.987622	40
9440	.974972	00	9510	.978180	00	9580	.981365	00	9650	.984527	00	9720	.987666	00
1	.975018	05	1	.978226	05	1	.981411	05	1	.984572	05	1	.987711	04
2	.975064	09	2	.978272	09	2	.981456	09	2	.984617	09	2	.987756	09
3	.975110	14	3	.978317	14	3	.981501	14	3	.984662	14	3	.987800	13
4	.975156	18	4	.978363	18	4	.981547	18	4	.984707	18	4	.987845	18
5	.975202	23	5	.978409	23	5	.981592	23	5	.984752	23	5	.987890	22
6	.975248	28	6	.978454	27	6	.981637	27	6	.984797	27	6	.987934	27
7	.975294	32	7	.978500	32	7	.981683	32	7	.984842	32	7	.987979	31
8	.975340	37	8	.978546	37	8	.981728	36	8	.984887	36	8	.988024	36
9	.975386	41	9	.978591	41	9	.981773	41	9	.984932	41	9	.988068	40
9450	.975432	00	9520	.978637	00	9590	.981819	00	9660	.984977	00	9730	.988113	00
1	.975478	05	1	.978683	05	1	.981864	05	1	.985022	05	1	.988157	04
2	.975524	09	2	.978728	09	2	.981909	09	2	.985067	09	2	.988202	09
3	.975570	14	3	.978774	14	3	.981954	14	3	.985112	14	3	.988247	13
4	.975616	18	4	.978819	18	4	.982000	18	4	.985157	18	4	.988291	18
5	.975661	23	5	.978865	23	5	.982045	23	5	.985202	23	5	.988336	22
6	.975707	28	6	.978911	27	6	.982090	27	6	.985247	27	6	.988381	27
7	.975753	32	7	.978956	32	7	.982135	32	7	.985292	32	7	.988425	31
8	.975799	37	8	.979002	36	8	.982181	36	8	.985337	36	8	.988470	36
9	.975845	41	9	.979047	41	9	.982226	41	9	.985382	41	9	.988514	40
9460	.975891	00	9530	.979093	00	9600	.982271	00	9670	.985426	00	9740	.988559	00
1	.975937	05	1	.979138	05	1	.982316	05	1	.985471	04	1	.988603	04
2	.975983	09	2	.979184	09	2	.982362	09	2	.985516	09	2	.988648	09
3	.976029	14	3	.979230	14	3	.982407	14	3	.985561	13	3	.988693	13
4	.976075	18	4	.979275	18	4	.982452	18	4	.985606	18	4	.988737	18
5	.976121	23	5	.979321	23	5	.982497	23	5	.985651	22	5	.988782	22
6	.976166	28	6	.979366	27	6	.982543	27	6	.985696	27	6	.988826	27
7	.976212	32	7	.979412	32	7	.982588	32	7	.985741	31	7	.988871	31
8	.976258	37	8	.979457	36	8	.982633	36	8	.985786	36	8	.988915	36
9	.976304	41	9	.979503	41	9	.982678	41	9	.985830	40	9	.988960	40

Log. .989005 to .999957

No. 9750 to 9999.

(u.)

No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.	No.	Log.	Part.
9750	.989005	00	9800	.991226	00	9850	.993436	00	9900	.995635	00	9950	.997823	00
1	.989049	04	1	.991270	04	1	.993480	04	1	.995679	04	1	.997867	04
2	.989094	09	2	.991315	09	2	.993524	09	2	.995723	09	2	.997910	09
3	.989138	13	3	.991359	13	3	.993568	13	3	.995767	13	3	.997954	13
4	.989183	18	4	.991403	18	4	.993613	18	4	.995811	18	4	.997998	18
5	.989227	22	5	.991448	22	5	.993657	22	5	.995854	22	5	.998041	22
6	.989272	27	6	.991492	27	6	.993701	26	6	.995898	26	6	.998085	26
7	.989316	31	7	.991536	31	7	.993745	31	7	.995942	31	7	.998128	30
8	.989361	36	8	.991580	36	8	.993789	35	8	.995986	35	8	.998172	35
9	.989405	40	9	.991625	40	9	.993833	40	9	.996030	40	9	.998216	39
9760	.989450	00	9810	.991669	00	9860	.993877	00	9910	.996074	00	9960	.998259	00
1	.989494	04	1	.991713	04	1	.993921	04	1	.996117	04	1	.998303	04
2	.989539	09	2	.991757	09	2	.993965	09	2	.996161	09	2	.998346	09
3	.989583	13	3	.991802	13	3	.994009	13	3	.996205	13	3	.998390	13
4	.989628	18	4	.991846	18	4	.994053	18	4	.996249	18	4	.998434	17
5	.989672	22	5	.991890	22	5	.994097	22	5	.996293	22	5	.998477	22
6	.989717	27	6	.991934	27	6	.994141	26	6	.996336	26	6	.998521	26
7	.989761	31	7	.991979	31	7	.994185	31	7	.996380	31	7	.998564	30
8	.989806	36	8	.992023	36	8	.994229	35	8	.996424	35	8	.998608	35
9	.989850	40	9	.992067	40	9	.994273	40	9	.996468	40	9	.998652	39
9770	.989895	00	9820	.992111	00	9870	.994317	00	9920	.996512	00	9970	.998695	00
1	.989939	04	1	.992156	04	1	.994361	04	1	.996555	04	1	.998739	04
2	.989983	09	2	.992200	09	2	.994405	09	2	.996599	09	2	.998782	09
3	.990028	13	3	.992244	13	3	.994449	13	3	.996643	13	3	.998826	13
4	.990072	18	4	.992288	18	4	.994493	18	4	.996687	18	4	.998869	17
5	.990117	22	5	.992333	22	5	.994537	22	5	.996730	22	5	.998913	22
6	.990161	27	6	.992377	26	6	.994581	26	6	.996774	26	6	.998956	26
7	.990206	31	7	.992421	31	7	.994625	31	7	.996818	31	7	.999000	30
8	.990250	36	8	.992465	35	8	.994669	35	8	.996862	35	8	.999043	35
9	.990294	40	9	.992509	40	9	.994713	40	9	.996905	40	9	.999087	39
9780	.990339	00	9830	.992553	00	9880	.994757	00	9930	.996949	00	9980	.999130	00
1	.990383	04	1	.992598	04	1	.994801	04	1	.996993	04	1	.999174	04
2	.990428	09	2	.992642	09	2	.994845	09	2	.997037	09	2	.999218	09
3	.990472	13	3	.992686	13	3	.994889	13	3	.997080	13	3	.999261	13
4	.990516	18	4	.992730	18	4	.994933	18	4	.997124	18	4	.999305	17
5	.990561	22	5	.992774	22	5	.994977	22	5	.997168	22	5	.999348	22
6	.990605	27	6	.992818	26	6	.995021	26	6	.997212	26	6	.999392	26
7	.990650	31	7	.992863	31	7	.995064	31	7	.997255	31	7	.999435	30
8	.990694	36	8	.992907	35	8	.995108	35	8	.997299	35	8	.999478	35
9	.990738	40	9	.992951	40	9	.995152	40	9	.997343	39	9	.999522	39
9790	.990783	00	9840	.992995	00	9890	.995196	00	9940	.997386	00	9990	.999565	00
1	.990827	04	1	.993039	04	1	.995240	04	1	.997430	04	1	.999609	04
2	.990871	09	2	.993083	09	2	.995284	09	2	.997474	09	2	.999652	09
3	.990916	13	3	.993127	13	3	.995328	13	3	.997517	13	3	.999696	13
4	.990960	18	4	.993172	18	4	.995372	18	4	.997561	17	4	.999739	17
5	.991004	22	5	.993216	22	5	.995416	22	5	.997605	22	5	.999783	22
6	.991049	27	6	.993260	26	6	.995460	26	6	.997648	26	6	.999826	26
7	.991093	31	7	.993304	31	7	.995504	31	7	.997692	30	7	.999870	30
8	.991137	36	8	.993348	35	8	.995547	35	8	.997736	35	8	.999913	35
9	.991182	40	9	.993392	40	9	.995591	40	9	.997779	39	9	.999957	39

(u. 2)

Table of B for Clearing the Distance.

AA	B for Sun.	B for Star.	AA	B for Sun.	B for Star.	AA	B for Sun.	B for Star.	AA	B for Sun.	B for Star.
3°	6.301122	6.301123	20°	6.301143	6.301149	37°	6.301138	6.301150	54°	6.301135	6.301150
4	6.301131	6.301132	21	6.301142	6.301149	38	6.301138	6.301150	55	6.301134	6.301150
5	6.301136	6.301137	22	6.301142	6.301149	39	6.301138	6.301150	56	6.301134	6.301150
6	6.301139	6.301141	23	6.301142	6.301149	40	6.301138	6.301150	57	6.301134	6.301150
7	6.301141	6.301143	24	6.301142	6.301149	41	6.301137	6.301150	58	6.301134	6.301150
8	6.301142	6.301144	25	6.301142	6.301149	42	6.301137	6.301150	59	6.301134	6.301150
9	6.301143	6.301145	26	6.301141	6.301149	43	6.301137	6.301150	60	6.301134	6.301150
10	6.301143	6.301146	27	6.301141	6.301150	44	6.301137	6.301150	61	6.301134	6.301150
11	6.301143	6.301147	28	6.301141	6.301150	45	6.301137	6.301150	62	6.301134	6.301150
12	6.301143	6.301147	29	6.301141	6.301150	46	6.301137	6.301150	63	6.301133	6.301150
13	6.301143	6.301148	30	6.301140	6.301150	47	6.301136	6.301150	64	6.301133	6.301150
14	6.301143	6.301148	31	6.301140	6.301150	48	6.301136	6.301150	65	6.301133	6.301150
15	6.301143	6.301149	32	6.301140	6.301150	49	6.301136	6.301150	66	6.301133	6.301150
16	6.301143	6.301149	33	6.301139	6.301150	50	6.301135	6.301150	67	6.301133	6.301150
17	6.301143	6.301149	34	6.301139	6.301150	51	6.301135	6.301150	68	6.301133	6.301150
18	6.301143	6.301149	35	6.301139	6.301150	52	6.301135	6.301150	69	6.301132	6.301150
19	6.301143	6.301149	36	6.301139	6.301150	53	6.301135	6.301150	90	6.301132	6.301150

(v.)

Natural Versines to Seconds of Time.

sec.	0 ^m	1 ^m	2 ^m	3 ^m	4 ^m	5 ^m	6 ^m	7 ^m	8 ^m	9 ^m	10 ^m	11 ^m	sec.
0	0	10	39	86	152	238	343	466	609	771	952	1152	0
1	0	10	39	87	153	240	345	469	612	774	955	1155	1
2	0	10	39	88	155	241	346	471	614	777	958	1159	2
3	0	10	40	89	156	243	348	473	617	780	961	1162	3
4	0	11	41	90	157	244	350	475	619	782	964	1166	4
5	0	11	41	91	159	246	352	478	622	785	968	1169	5
6	0	12	42	92	160	248	354	480	624	788	971	1173	6
7	0	12	43	93	161	249	356	482	627	791	974	1176	7
8	0	12	43	93	163	251	358	484	630	794	977	1180	8
9	0	13	44	94	164	253	360	487	632	797	981	1183	9
10	0	13	45	95	165	254	362	489	635	800	984	1187	10
11	0	13	45	96	167	256	364	491	637	803	987	1190	11
12	0	14	46	97	168	257	366	493	640	806	990	1194	12
13	0	14	47	98	169	259	368	496	643	809	993	1197	13
14	1	14	47	99	171	261	370	498	645	811	997	1201	14
15	1	15	48	100	172	262	372	500	648	814	1000	1205	15
16	1	15	49	102	173	264	374	503	650	817	1003	1208	16
17	1	16	50	103	175	266	376	505	653	820	1006	1212	17
18	1	16	50	104	176	267	378	507	656	823	1010	1215	18
19	1	17	51	105	177	269	380	510	658	826	1013	1219	19
20	1	17	52	106	179	271	382	512	661	829	1016	1222	20
21	1	17	53	107	180	272	384	514	664	832	1020	1226	21
22	1	18	53	108	182	274	386	517	666	835	1023	1230	22
23	1	18	54	109	183	276	388	519	669	838	1026	1233	23
24	2	19	55	110	184	278	390	521	672	841	1029	1237	24
25	2	19	56	111	185	279	392	524	674	844	1033	1241	25
26	2	20	56	112	187	281	394	526	677	847	1036	1244	26
27	2	20	57	113	188	283	396	528	680	850	1039	1248	27
28	2	20	58	114	190	284	398	531	682	853	1043	1251	28
29	2	21	59	116	191	286	400	533	685	856	1046	1255	29
30	3	21	59	117	193	288	402	535	688	859	1049	1259	30
31	3	22	60	118	194	289	404	538	690	862	1053	1262	31
32	3	22	61	119	196	291	406	540	693	865	1056	1266	32
33	3	23	62	120	197	293	408	543	696	868	1059	1270	33
34	3	23	63	121	198	295	410	545	699	871	1062	1273	34
35	3	24	64	122	200	297	412	547	701	874	1066	1277	35
36	3	24	64	123	201	299	415	550	704	877	1069	1281	36
37	4	25	65	124	203	300	417	552	707	880	1073	1284	37
38	4	25	66	126	204	302	419	555	709	883	1076	1288	38
39	4	26	67	127	206	304	421	557	712	886	1079	1292	39
40	4	26	68	128	207	306	423	559	715	889	1083	1295	40
41	4	27	68	129	209	307	425	562	718	892	1086	1299	41
42	5	28	69	130	210	309	427	564	720	896	1090	1303	42
43	5	28	70	131	212	311	429	567	723	899	1093	1307	43
44	5	29	71	133	213	313	432	569	726	902	1096	1310	44
45	5	29	72	134	215	315	434	572	729	905	1100	1314	45
46	6	30	73	135	216	316	436	574	732	908	1103	1318	46
47	6	30	74	136	218	318	438	577	734	911	1107	1321	47
48	6	31	75	137	219	320	440	579	737	914	1110	1325	48
49	6	31	75	139	221	322	442	582	740	917	1114	1329	49
50	7	32	76	140	222	324	444	584	743	920	1117	1333	50
51	7	33	77	141	225	326	447	587	745	923	1120	1336	51
52	7	33	78	142	226	328	449	589	748	927	1124	1340	52
53	7	34	75	144	227	329	451	592	751	930	1127	1344	53
54	8	34	80	145	229	331	453	594	754	933	1131	1348	54
55	8	35	81	146	230	333	455	597	757	936	1134	1352	55
56	8	36	82	147	232	335	458	599	760	939	1138	1355	56
57	8	36	83	149	233	337	460	602	763	942	1141	1359	57
58	8	37	84	150	235	339	462	604	765	945	1145	1363	58
59	9	37	85	151	236	341	464	607	768	949	1148	1367	59
60	10	38	86	152	238	343	466	609	771	952	1152	1370	60

Natural Versines to Seconds of Time

(v.)

sec.	12 ^m	13 ^m	14 ^m	15 ^m	16 ^m	17 ^m	18 ^m	19 ^m	20 ^m	21 ^m	22 ^m	23 ^m	sec.
0	1370	1608	1865	2141	2436	2750	3083	3434	3805	4195	4604	5031	0
1	1374	1612	1870	2146	2441	2755	3088	3441	3812	4202	4611	5039	1
2	1378	1617	1874	2151	2446	2761	3093	3447	3818	4208	4618	5046	2
3	1382	1621	1879	2155	2451	2766	3099	3453	3824	4215	4625	5053	3
4	1386	1625	1883	2160	2456	2771	3106	3459	3831	4222	4632	5061	4
5	1390	1629	1887	2165	2461	2777	3111	3465	3837	4228	4639	5068	5
6	1393	1633	1892	2170	2466	2782	3117	3471	3843	4235	4646	5075	6
7	1397	1637	1896	2175	2472	2788	3123	3477	3850	4242	4653	5083	7
8	1401	1641	1901	2179	2477	2793	3128	3483	3856	4248	4660	5090	8
9	1405	1646	1905	2184	2482	2799	3134	3489	3863	4255	4667	5097	9
10	1409	1650	1910	2189	2487	2804	3140	3495	3869	4262	4674	5105	10
11	1413	1654	1914	2194	2492	2809	3146	3501	3875	4269	4681	5112	11
12	1416	1658	1919	2198	2497	2815	3151	3507	3882	4275	4688	5119	12
13	1420	1662	1923	2203	2502	2820	3157	3513	3888	4282	4695	5127	13
14	1424	1667	1928	2208	2507	2826	3163	3519	3895	4289	4702	5134	14
15	1428	1671	1932	2213	2513	2831	3169	3525	3901	4295	4709	5141	15
16	1432	1675	1937	2218	2518	2837	3175	3531	3907	4302	4716	5149	16
17	1436	1679	1941	2223	2523	2842	3180	3538	3914	4309	4723	5156	17
18	1440	1683	1946	2227	2528	2848	3186	3544	3920	4316	4730	5163	18
19	1444	1688	1950	2232	2533	2853	3192	3550	3927	4322	4737	5171	19
20	1448	1692	1955	2237	2538	2859	3198	3556	3933	4329	4744	5178	20
21	1451	1696	1960	2242	2544	2864	3204	3562	3940	4336	4751	5186	21
22	1455	1700	1964	2247	2549	2870	3209	3568	3946	4343	4758	5193	22
23	1459	1705	1968	2252	2554	2875	3215	3574	3952	4350	4766	5200	23
24	1463	1709	1973	2257	2559	2881	3221	3581	3959	4356	4773	5208	24
25	1467	1713	1978	2262	2564	2886	3227	3587	3965	4363	4780	5215	25
26	1471	1717	1982	2266	2570	2892	3233	3593	3972	4370	4787	5223	26
27	1475	1722	1987	2272	2575	2897	3239	3599	3978	4377	4794	5230	27
28	1479	1726	1992	2276	2580	2903	3244	3605	3985	4383	4801	5237	28
29	1483	1730	1997	2281	2585	2908	3250	3611	3991	4390	4808	5245	29
30	1487	1734	2001	2286	2590	2914	3256	3618	3998	4397	4815	5252	30
31	1491	1739	2005	2291	2596	2919	3262	3624	4004	4404	4822	5260	31
32	1495	1743	2010	2296	2601	2925	3268	3630	4011	4411	4829	5267	32
33	1499	1747	2014	2301	2606	2930	3274	3636	4017	4418	4837	5275	33
34	1503	1751	2019	2306	2611	2936	3280	3642	4024	4424	4844	5282	34
35	1507	1756	2024	2311	2617	2942	3286	3648	4030	4431	4851	5290	35
36	1511	1760	2028	2316	2622	2947	3291	3655	4037	4438	4858	5297	36
37	1515	1764	2033	2321	2627	2952	3297	3661	4043	4445	4865	5305	37
38	1519	1769	2038	2326	2632	2958	3303	3667	4050	4452	4872	5312	38
39	1523	1773	2042	2331	2638	2964	3309	3673	4056	4459	4880	5320	39
40	1527	1777	2047	2335	2643	2970	3315	3680	4063	4465	4887	5327	40
41	1531	1782	2052	2340	2648	2975	3321	3686	4070	4472	4894	5335	41
42	1535	1786	2056	2345	2654	2981	3327	3692	4076	4479	4901	5342	42
43	1539	1790	2061	2350	2659	2986	3333	3698	4083	4486	4908	5350	43
44	1543	1795	2066	2355	2664	2992	3339	3705	4089	4493	4916	5357	44
45	1547	1799	2070	2360	2669	2998	3345	3711	4096	4500	4923	5365	45
46	1551	1804	2075	2365	2675	3003	3351	3717	4102	4507	4930	5372	46
47	1555	1808	2080	2370	2680	3009	3357	3723	4109	4514	4937	5380	47
48	1559	1812	2084	2375	2685	3015	3363	3730	4116	4520	4944	5387	48
49	1563	1817	2089	2380	2691	3020	3369	3736	4122	4527	4952	5395	49
50	1567	1821	2094	2385	2696	3026	3375	3742	4129	4534	4959	5402	50
51	1571	1825	2099	2390	2701	3031	3380	3749	4135	4541	4966	5410	51
52	1575	1830	2103	2395	2707	3037	3386	3755	4142	4548	4973	5417	52
53	1580	1834	2108	2401	2712	3043	3392	3761	4149	4555	4981	5425	53
54	1584	1839	2113	2406	2718	3049	3398	3767	4155	4562	4988	5433	54
55	1588	1843	2117	2411	2723	3054	3404	3774	4162	4569	4995	5440	55
56	1592	1847	2122	2416	2728	3060	3410	3780	4168	4576	5002	5448	56
57	1596	1852	2127	2421	2734	3066	3416	3786	4175	4583	5010	5455	57
58	1600	1856	2132	2426	2739	3071	3422	3793	4182	4590	5017	5463	58
59	1604	1861	2136	2431	2744	3077	3428	3799	4188	4597	5024	5470	59
60	1608	1865	2141	2436	2750	3083	3434	3805	4195	4604	5031	5478	60

Natural Versines to Seconds of Time.

(v.)

sec.	24 ^m	25 ^m	26 ^m	27 ^m	28 ^m	29 ^m	30 ^m	31 ^m	32 ^m	33 ^m	34 ^m	35 ^m	sec.
0	5478	5944	6428	6931	7454	7995	8555	9134	9732	10349	10984	11638	0
1	5486	5952	6436	6940	7463	8004	8564	9144	9742	10359	10995	11649	1
2	5494	5960	6445	6949	7472	8013	8574	9154	9752	10369	11006	11661	2
3	5501	5967	6453	6957	7481	8023	8583	9164	9762	10379	11016	11672	3
4	5509	5975	6461	6966	7489	8032	8593	9173	9772	10390	11027	11683	4
5	5516	5983	6469	6974	7498	8041	8602	9183	9782	10400	11038	11694	5
6	5524	5991	6478	6983	7507	8050	8612	9193	9793	10411	11049	11705	6
7	5531	5999	6486	6991	7516	8059	8621	9203	9803	10421	11059	11716	7
8	5539	6007	6494	7000	7525	8069	8631	9213	9813	10432	11070	11727	8
9	5547	6015	6502	7009	7534	8078	8641	9223	9823	10442	11081	11738	9
10	5554	6023	6511	7017	7543	8087	8650	9232	9833	10453	11092	11749	10
11	5562	6031	6519	7026	7552	8096	8659	9242	9843	10463	11102	11760	11
12	5570	6039	6527	7034	7561	8106	8669	9252	9854	10474	11114	11772	12
13	5577	6047	6536	7043	7570	8115	8679	9262	9864	10484	11124	11783	13
14	5585	6055	6544	7052	7579	8124	8689	9272	9874	10495	11135	11794	14
15	5593	6063	6551	7060	7587	8133	8698	9282	9884	10495	11146	11805	15
16	5600	6071	6560	7069	7596	8143	8708	9292	9895	10516	11157	11816	16
17	5608	6079	6569	7078	7605	8152	8717	9301	9905	10526	11167	11827	17
18	5616	6087	6577	7086	7614	8161	8727	9311	9915	10537	11178	11838	18
19	5623	6095	6585	7095	7623	8170	8736	9321	9925	10547	11189	11849	19
20	5631	6103	6594	7103	7632	8180	8746	9331	9935	10558	11200	11861	20
21	5639	6111	6602	7112	7641	8189	8755	9341	9945	10568	11211	11872	21
22	5647	6119	6610	7121	7650	8198	8765	9351	9956	10579	11222	11883	22
23	5654	6127	6619	7130	7659	8207	8774	9361	9966	10590	11233	11894	23
24	5662	6135	6627	7138	7668	8217	8784	9371	9976	10601	11244	11906	24
25	5670	6143	6636	7147	7677	8226	8794	9381	9986	10611	11254	11917	25
26	5678	6151	6644	7156	7686	8235	8804	9391	9997	10622	11265	11928	26
27	5685	6159	6652	7164	7695	8245	8813	9401	10007	10632	11276	11939	27
28	5693	6167	6661	7173	7704	8254	8823	9411	10017	10643	11287	11950	28
29	5701	6175	6669	7182	7713	8263	8832	9421	10027	10653	11298	11961	29
30	5709	6183	6678	7190	7722	8273	8842	9431	10038	10664	11309	11973	30
31	5716	6192	6686	7199	7731	8282	8852	9441	10048	10674	11320	11984	31
32	5724	6200	6694	7208	7740	8291	8862	9451	10058	10685	11331	11995	32
33	5732	6208	6703	7217	7749	8301	8872	9461	10068	10695	11342	12006	33
34	5740	6216	6711	7226	7758	8310	8881	9471	10079	10706	11353	12018	34
35	5747	6224	6719	7234	7767	8319	8891	9481	10089	10716	11364	12029	35
36	5755	6232	6728	7243	7776	8329	8900	9491	10100	10728	11374	12040	36
37	5763	6240	6736	7251	7785	8338	8910	9501	10110	10738	11385	12051	37
38	5771	6248	6745	7260	7794	8348	8920	9511	10120	10749	11396	12063	38
39	5779	6256	6753	7269	7804	8357	8930	9521	10130	10759	11407	12074	39
40	5786	6264	6762	7278	7813	8366	8939	9531	10141	10770	11418	12085	40
41	5794	6273	6770	7286	7822	8376	8949	9541	10151	10781	11429	12096	41
42	5802	6281	6778	7295	7831	8385	8958	9551	10162	10792	11440	12108	42
43	5810	6289	6787	7304	7840	8394	8968	9561	10172	10802	11452	12119	43
44	5818	6297	6795	7313	7849	8404	8978	9571	10182	10813	11462	12130	44
45	5826	6305	6804	7321	7858	8413	8988	9581	10192	10823	11473	12141	45
46	5833	6313	6812	7330	7867	8423	8997	9591	10203	10834	11484	12153	46
47	5841	6322	6821	7339	7876	8432	9007	9601	10213	10844	11495	12164	47
48	5849	6330	6829	7348	7885	8442	9017	9611	10224	10855	11506	12176	48
49	5857	6338	6838	7357	7894	8451	9027	9621	10234	10865	11517	12187	49
50	5865	6346	6846	7365	7903	8460	9036	9631	10245	10877	11528	12198	50
51	5873	6354	6855	7374	7913	8470	9046	9641	10255	10887	11539	12209	51
52	5881	6362	6863	7383	7922	8479	9056	9651	10265	10898	11550	12221	52
53	5888	6371	6872	7392	7931	8489	9066	9661	10275	10909	11561	12232	53
54	5896	6379	6880	7401	7940	8498	9075	9671	10286	10920	11572	12243	54
55	5904	6387	6889	7410	7949	8508	9085	9681	10296	10930	11583	12254	55
56	5912	6395	6897	7418	7958	8517	9095	9691	10307	10941	11594	12266	56
57	5920	6403	6906	7427	7968	8527	9105	9701	10317	10952	11605	12277	57
58	5928	6411	6914	7436	7977	8536	9114	9712	10328	10963	11616	12289	58
59	5936	6420	6923	7445	7986	8546	9124	9722	10338	10973	11627	12300	59
60	5944	6428	6931	7454	7995	8555	9134	9732	10349	10984	11638	12312	60

Nat. Versines.

(v.)

	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	
0	0000000	0000152	0000609	0001370	0002436	0003805	0005478	0007454	0009732	0012312	0
1	0000000	0000157	0000619	0001386	0002456	0003831	0005509	0007489	0009772	0012357	1
2	000000	00163	00630	01401	02477	03856	05539	07525	09813	12403	2
3	00000	00168	00640	01416	02497	03882	05570	07561	09854	12449	3
4	0000001	0000173	0000650	0001432	0002518	0003907	0005600	0007596	0009894	0012494	4
5	00001	00179	00661	01448	02538	03933	05631	07632	09935	12540	5
6	00001	00184	00672	01463	02559	03959	05662	07668	09976	12586	6
7	0000002	0000190	0000682	0001479	0002580	0003985	0005693	0007704	0010017	0012632	7
8	00003	00196	00693	01495	02601	04011	05724	07740	10058	12678	8
9	00003	00201	00704	01511	02622	04037	05755	07776	10100	12725	9
10	0000004	0000207	0000715	0001527	0002643	0004063	0005786	0007813	0010141	0012771	10
11	00005	00213	00726	01543	02664	04089	05818	07849	10182	12817	11
12	00006	00219	00737	01559	02685	04116	05849	07865	10224	12864	12
13	0000007	0000226	0000748	0001575	0002707	0004142	0005880	0007922	0010265	0012910	13
14	00008	00232	00760	01592	02728	04168	05912	07958	10307	12957	14
15	00009	00238	00771	01608	02750	04195	05944	07995	10349	13004	15
16	0000011	0000244	0000782	0001625	0002771	0004222	0005975	0008032	0010390	0013050	16
17	00012	00251	00794	01641	02793	04248	06007	08069	10432	13097	17
18	00014	00257	00806	01658	02815	04275	06039	08106	10474	13144	18
19	0000015	0000264	0000817	0001675	0002837	0004392	0006071	0008143	0010516	0013191	19
20	00017	00271	00829	01692	02859	04329	06103	08180	10558	13238	20
21	00019	00278	00841	01709	02881	04356	06135	08217	10601	13286	21
22	0000020	0000284	0000853	0001726	0002903	0004383	0006167	0008254	0010643	0013333	22
23	00022	00291	00865	01743	02925	04411	06200	08291	10685	13380	23
24	00024	00299	00877	01760	02947	04438	06232	08329	10728	13428	24
25	0000026	0000306	0000889	0001777	0002970	0004465	0006264	0008366	0010770	0013475	25
26	00029	00313	00902	01795	02992	04493	06297	08404	10813	13523	26
27	00031	00320	00914	01812	03015	04520	06330	08442	10855	13571	27
28	0000033	0000328	0000927	0001830	0003037	0004548	0006362	0008479	0010898	0013618	28
29	00036	00335	00939	01847	03060	04576	06395	08517	10941	13666	29
30	00038	00343	00952	01865	03083	04604	06428	08555	10984	13714	30
31	0000041	0000350	0000964	0001883	0003105	0004632	0006461	0008593	0011027	0013762	31
32	00043	00358	00977	01901	03128	04660	06494	08631	11070	13811	32
33	00046	00366	00990	01919	03151	04688	06527	08669	11113	13859	33
34	0000049	0000374	0001003	0001937	0003175	0004716	0006560	0008708	0011157	0013907	34
35	00052	00382	01016	01955	03198	04744	06594	08746	11200	13955	35
36	00055	00390	01029	01973	03221	04773	06627	08784	11244	14004	36
37	0000058	0000398	0001043	0001992	0003244	0004801	0006661	0008823	0011287	0014052	37
38	00061	00406	01056	02010	03268	04829	06694	08862	11331	14101	38
39	00064	00415	01069	02028	03291	04858	06728	08900	11374	14150	39
40	0000068	0000423	0001083	0002047	0003315	0004887	0006762	0008939	0011418	0014199	40
41	00071	00432	01096	02066	03339	04916	06795	08978	11462	14248	41
42	00075	00440	01110	02084	03363	04944	06829	09017	11506	14296	42
43	0000078	0000449	0001124	0002103	0003386	0004973	0006863	0009056	0011550	0014346	43
44	00082	00458	01138	02122	03410	05002	06897	09095	11594	14395	44
45	00086	00466	01152	02141	03434	05031	06931	09134	11638	14444	45
46	0000089	0000475	0001166	0002160	0003459	0005061	0006966	0009173	0011683	0014493	46
47	00093	00484	01180	02179	03483	05099	07000	09213	11727	14543	47
48	00097	00493	01194	02198	03507	05119	07034	09252	11772	14592	48
49	0000102	0000503	0001208	0002218	0003531	0005149	0007069	0009292	0011816	0014642	49
50	00106	00512	01222	02237	03556	05178	07103	09331	11861	14691	50
51	00110	00521	01237	02257	03580	05208	07138	09371	11905	14741	51
52	0000114	0000531	0001251	0002276	0003605	0005237	0007173	0009411	0011950	0014791	52
53	00119	00540	01266	02296	03630	05267	07208	09451	11995	14841	53
54	00123	00550	01281	02316	03655	05297	07243	09490	12040	14891	54
55	0000128	0000559	0001295	0002335	0003680	0005327	0007278	0009531	0012085	0014941	55
56	00133	00569	01310	02355	03705	05357	07313	09571	12130	14991	56
57	00137	00579	01325	02375	03730	05387	07348	09611	12175	15041	57
58	0000142	0000589	0001340	0002395	0003755	0005417	0007383	0009651	0012221	0015091	58
59	00147	00599	01355	02416	03780	05448	07418	09691	12266	15142	59
60	00152	00609	01370	02436	03805	05478	07454	09732	12312	15192	60

Parts for Seconds.

(v.)

	0°		1°		2°		3°		4°		5°		6°		7°		8°		9°		10°		
	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2
3	0	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3
4	0	0	0	0	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	4	4
5	0	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	5	5
6	0	0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	6	6
7	0	0	1	1	1	1	2	2	2	3	3	3	3	3	4	4	5	5	5	6	6	7	7
8	0	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	8	8
9	0	0	1	1	1	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	8	9	9
10	0	0	1	1	2	2	2	3	3	4	4	5	5	5	6	6	7	7	8	8	9	10	10
11	0	0	1	1	2	2	3	3	4	4	5	5	6	6	6	7	7	8	8	9	9	11	11
12	0	0	1	1	2	2	3	3	4	5	5	6	6	7	7	8	8	9	9	10	10	12	12
13	0	0	1	2	2	3	3	4	4	5	5	6	7	7	8	8	9	9	10	10	11	13	13
14	0	0	1	2	2	3	3	4	5	5	6	6	7	8	8	9	9	10	11	11	12	14	14
15	0	1	1	2	2	3	4	4	5	6	6	7	8	8	9	9	10	11	11	12	13	15	15
16	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12	13	14	16	16
17	0	1	1	2	3	4	4	5	6	6	7	8	8	9	10	11	11	12	13	14	15	17	17
18	0	1	1	2	3	4	5	5	6	7	8	8	9	10	11	11	12	13	14	14	15	18	18
19	0	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14	15	16	19	19
20	0	1	2	2	3	4	5	6	7	8	8	9	10	11	12	13	13	14	15	16	17	20	20
21	0	1	2	3	3	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	21	21
22	0	1	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	17	18	19	22	22
23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	23	23
24	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	24	24
25	0	1	2	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21	25	25
26	0	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	17	19	20	21	22	26	26
27	0	1	2	3	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	22	23	27	27
28	0	1	2	3	5	6	7	8	9	11	12	13	14	15	16	18	19	20	21	22	24	28	28
29	0	1	2	4	5	6	7	9	10	11	12	13	15	16	17	18	19	21	22	23	24	29	29
30	0	1	2	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	23	24	25	30	30
31	0	1	3	4	5	7	8	9	10	12	13	14	16	17	18	20	21	22	23	25	26	31	31
32	0	1	3	4	5	7	8	9	11	12	13	15	16	17	19	20	22	23	24	26	27	32	32
33	0	1	3	4	6	7	8	10	11	12	14	15	17	18	19	21	22	24	25	26	28	33	33
34	0	1	3	4	6	7	9	10	11	13	14	16	17	19	20	21	23	24	26	27	29	34	34
35	0	1	3	4	6	7	9	10	12	13	15	16	18	19	21	22	24	25	26	28	29	35	35
36	0	1	3	5	6	8	9	11	12	14	15	17	18	20	21	23	24	26	27	29	30	36	36
37	0	1	3	5	6	8	9	11	12	14	16	17	19	20	22	23	25	26	28	30	31	37	37
38	0	2	3	5	6	8	10	11	13	14	16	18	19	21	22	24	26	27	29	30	32	38	38
39	0	2	3	5	7	8	10	11	13	15	16	18	20	21	23	25	26	28	30	31	33	39	39
40	0	2	3	5	7	8	10	12	13	15	17	18	20	22	24	25	27	29	30	32	34	40	40
41	0	2	3	5	7	9	10	12	14	16	17	19	21	22	24	26	28	29	31	33	35	41	41
42	0	2	3	5	7	9	11	12	14	16	18	19	21	23	25	27	28	30	32	34	35	42	42
43	0	2	4	5	7	9	11	13	14	16	18	20	22	24	25	27	29	31	33	34	36	43	43
44	0	2	4	6	7	9	11	13	15	17	19	20	22	24	26	28	30	31	33	35	37	44	44
45	0	2	4	6	8	9	11	13	15	17	19	21	23	25	27	28	30	32	34	36	38	45	45
46	0	2	4	6	8	10	12	14	16	17	19	21	23	25	27	29	31	33	35	37	39	46	46
47	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	47	47
48	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	48	48
49	0	2	4	6	8	10	12	14	16	19	21	23	25	27	29	31	33	35	37	39	41	49	49
50	0	2	4	6	8	10	13	15	17	19	21	23	25	27	29	32	34	36	38	40	42	50	50
51	0	2	4	6	9	11	13	15	17	19	21	24	26	28	30	32	34	36	39	41	43	51	51
52	0	2	4	7	9	11	13	15	18	20	22	24	26	28	31	33	35	37	39	42	44	52	52
53	0	2	4	7	9	11	13	16	18	20	22	25	27	29	31	33	36	38	40	42	45	53	53
54	0	2	4	7	9	11	14	16	18	20	23	25	27	30	32	34	36	39	41	43	45	54	54
55	0	2	5	7	9	12	14	16	19	21	23	25	28	30	32	35	37	39	42	44	46	55	55
56	0	2	5	7	9	12	14	17	19	21	24	26	28	31	33	35	38	40	42	45	47	56	56
57	0	2	5	7	10	12	14	17	19	22	24	26	29	31	34	36	38	41	43	46	48	57	57
58	0	2	5	7	10	12	15	17	20	22	24	27	29	32	34	37	39	42	44	46	49	58	58
59	0	2	5	7	10	12	15	17	20	22	25	27	30	32	35	37	40	42	45	47	50	59	59
60	0	2	5	8	10	13	15	18	20	23	25	28	30	33	35	38	40	43	45	48	50½	60	60

Nat. Versines.

(v.)

	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	
0	0015192	0018373	0021852	0025630	0029704	0034074	0038738	0043695	0048943	0054481	0
1	0015243	0018428	0021913	0025695	0029775	0034149	0038818	0043780	0049033	0054576	1
2	15293	18484	21973	25761	29845	34235	38899	43865	49123	54671	2
3	15344	18540	22034	25827	29916	34300	38979	43951	49213	54766	3
4	0015395	0018595	0022095	0025892	0029986	0034376	0039060	0044036	0049304	0054861	4
5	15446	18651	22156	25958	30057	34452	39140	44121	49394	54956	5
6	15497	18707	22217	26024	30128	34527	39221	44207	49484	55051	6
7	0015548	0018763	0022278	0026090	0030199	0034603	0039302	0044293	0049575	0055146	7
8	15599	18819	22339	26156	30270	34679	39382	44378	49665	55242	8
9	15650	18876	22400	26222	30341	34755	39463	44464	49756	55337	9
10	0015701	0018932	0022461	0026288	0030412	0034831	0039544	0044550	0049846	0055432	10
11	15753	18988	22523	26355	30483	34907	39625	44636	49937	55528	11
12	15804	19045	22584	26421	30555	34983	39706	44722	50028	55624	12
13	0015856	0019101	0022646	0026488	0030626	0035060	0039787	0044808	0050119	0055719	13
14	15908	19158	22707	26554	30697	35136	39869	44894	50210	55815	14
15	15959	19215	22769	26621	30769	35213	39950	44980	50301	55911	15
16	0016011	0019271	0022831	0026687	0030841	0035289	0040032	0045066	0050392	0056007	16
17	16063	19328	22892	26754	30912	35366	40113	45153	50483	56103	17
18	16115	19385	22954	26821	30984	35443	40195	45239	50574	56199	18
19	0016167	0019442	0023016	0026888	0031056	0035519	0040276	0045326	0050666	0056295	19
20	16219	19499	23078	26955	31128	35596	40358	45412	50757	56391	20
21	16271	19557	23141	27022	31200	35673	40440	45499	50849	56488	21
22	0016324	0019614	0023203	0027089	0031272	0035750	0040522	0045586	0050940	0056584	22
23	16376	19671	23265	27157	31344	35827	40604	45673	51032	56681	23
24	16428	19729	23328	27224	31417	35905	40686	45760	51124	56777	24
25	0016481	0019786	0023390	0027292	0031489	0035982	0040768	0045847	0051216	0056874	25
26	16534	19844	23453	27359	31562	36059	40850	45934	51308	56971	26
27	16586	19902	23515	27427	31634	36137	40933	46021	51400	57068	27
28	0016639	0019959	0023578	0027494	0031707	0036214	0041015	0046108	0051492	0057164	28
29	16692	20017	23641	27562	31780	36292	41098	46196	51584	57261	29
30	16745	20075	23704	27630	31852	36369	41180	46283	51676	57358	30
31	0016798	0020133	0023767	0027698	0031925	0036447	0041263	0046371	0051769	0057456	31
32	16851	20191	23830	27766	31998	36525	41346	46458	51861	57553	32
33	16904	20250	23893	27834	32071	36603	41428	46546	51954	57650	33
34	0016958	0020308	0023956	0027902	0032144	0036681	0041511	0046634	0052046	0057747	34
35	17011	20366	24020	27971	32217	36759	41594	46721	52139	57845	35
36	17065	20425	24083	28039	32291	36837	41677	46809	52232	57942	36
37	0017118	0020483	0024147	0028107	0032364	0036916	0041761	0046897	0052324	0058040	37
38	17172	20542	24210	28176	32438	36994	41844	46985	52417	58138	38
39	17226	20601	24274	28245	32511	37072	41927	47074	52510	58236	39
40	0017279	0020659	0024338	0028313	0032585	0037151	0042010	0047162	0052603	0058333	40
41	17333	20718	24401	28382	32658	37230	42094	47250	52696	58391	41
42	17387	20777	24465	28451	32732	37308	42177	47338	52790	58529	42
43	0017441	0020836	0024529	0028520	0032806	0037387	0042261	0047427	0052883	0058628	43
44	17495	20895	24593	28589	32880	37466	42345	47516	52976	58726	44
45	17550	20954	24658	28658	32954	37545	42429	47604	53070	58824	45
46	0017604	0021014	0024722	0028727	0033028	0037624	0042512	0047693	0053163	0058922	46
47	17658	21073	24786	28796	33102	37703	42596	47782	53257	59021	47
48	17713	21133	24851	28866	33177	37782	42680	47871	53351	59119	48
49	0017767	0021192	0024915	0028935	0033251	0037861	0042765	0047960	0053444	0059218	49
50	17822	21252	24980	29005	33325	37941	42849	48049	53538	59316	50
51	17877	21311	25044	29074	33400	38020	42933	48138	53632	59415	51
52	0017931	0021371	0025109	0029144	0033474	0038099	0043017	0048227	0053726	0059514	52
53	17986	21431	25174	29214	33549	38179	43102	48316	53820	59613	53
54	18041	21491	25239	29283	33624	38259	43186	48406	53915	59712	54
55	0018096	0021551	0025304	0029353	0033699	0038338	0043271	0048495	0054009	0059811	55
56	18151	21611	25369	29423	33774	38418	43356	48585	54103	59910	56
57	18207	21671	25434	29493	33849	38498	43440	48674	54198	60009	57
58	0018262	0021732	0025499	0029564	0033924	0038578	0043525	0048764	0054292	0060109	58
59	18317	21792	25564	29634	33999	38658	43610	48854	54387	60208	59
60	18373	21852	25630	29704	34074	38738	43695	48943	54481	60307	60

Parts for Seconds.

(v.)

	10°		11°		12°		13°		14°		15°		16°		17°		18°		19°		20°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1
2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2
3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	3
4	4	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	6	7	4
5	5	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	5
6	4	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	9	10	10	6
7	6	6	6	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	7
8	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	8
9	8	8	8	9	9	9	10	10	11	11	11	11	12	12	13	13	13	14	14	15	15	9
10	8	9	9	10	10	10	11	11	12	12	13	13	13	14	14	15	15	16	16	16	17	10
11	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	18	19	11
12	10	11	11	12	12	13	13	14	14	15	16	16	17	17	18	18	19	20	20	21	22	12
13	11	12	12	13	13	14	14	15	16	16	17	18	18	19	19	20	20	21	22	23	23	13
14	12	13	14	14	15	16	16	17	18	18	19	19	20	20	21	22	22	23	24	24	25	14
15	13	14	15	15	16	17	18	19	19	20	21	22	23	23	24	25	26	27	28	29	30	15
16	13	14	15	16	17	18	19	20	20	21	22	23	24	25	26	27	28	29	30	31	32	16
17	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	17
18	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	18
19	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	19
20	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	20
21	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	21
22	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	22
23	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	40	23
24	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	41	24
25	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	25
26	22	23	24	25	26	27	28	29	31	32	33	34	35	36	37	38	39	40	41	42	43	26
27	23	24	25	26	27	28	29	31	32	33	34	35	36	37	38	39	41	42	43	44	45	27
28	24	25	26	27	28	29	31	32	33	34	35	36	37	39	40	41	42	43	44	45	46	28
29	24	26	27	28	29	30	32	33	34	35	36	38	39	40	41	42	43	45	46	47	48	29
30	25	27	28	29	30	31	33	34	35	36	38	39	40	41	43	43	45	46	47	49	50	30
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32	27	28	30	31	32	34	35	36	38	39	40	41	43	44	45	47	48	49	51	52	53	32
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36	30	32	33	35	36	38	39	41	42	44	45	47	48	50	51	52	54	55	57	58	60	36
37	31	33	34	36	37	39	40	42	43	45	46	48	49	51	52	54	55	57	58	60	61	37
38	32	34	35	37	38	40	41	43	45	46	48	49	51	52	54	55	57	58	60	61	63	38
39	33	34	36	38	39	41	43	44	46	47	49	50	52	54	55	57	58	60	62	63	65	39
40	34	35	37	39	40	42	44	45	47	49	50	52	53	55	57	58	60	62	63	65	66	40
41	35	36	38	40	41	43	45	46	48	50	51	53	55	56	58	60	61	63	65	66	68	41
42	35	37	39	41	42	44	46	48	49	51	53	54	56	58	60	61	63	65	66	68	70	42
43	36	38	40	42	43	45	47	49	50	52	54	56	57	59	61	63	65	66	68	70	71	43
44	37	39	41	43	44	46	48	50	52	53	55	57	59	61	62	64	66	68	69	71	73	44
45	38	40	42	44	45	47	49	51	53	55	56	58	60	62	64	66	67	69	71	73	75	45
46	39	41	43	44	46	48	50	52	54	56	58	60	61	63	65	67	69	71	73	74	76	46
47	40	42	43	45	47	49	51	53	55	57	59	61	63	65	67	69	70	72	74	76	78	47
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49	41	43	45	47	49	51	53	55	57	59	61	63	65	68	69	71	73	75	77	79	81	49
50	42	44	46	48	50	52	55	57	59	61	63	65	67	69	71	73	75	77	79	80	83	50
51	43	45	46	49	51	54	56	58	60	62	64	66	68	70	72	74	76	78	80	83	85	51
52	44	46	47	50	52	55	57	59	61	63	65	67	69	72	74	76	78	80	82	84	86	52
53	45	47	48	51	53	56	58	60	62	64	67	69	71	73	75	77	79	82	84	86	88	53
54	45	48	49	52	54	57	59	61	63	66	68	70	72	74	77	79	80	83	85	87	90	54
55	46	49	50	53	55	58	60	62	65	67	69	71	73	76	78	80	82	85	87	89	91	55
56	47	49	51	54	56	59	61	63	66	68	70	73	74	77	79	82	84	86	88	91	93	56
57	48	50	52	55	57	60	62	65	67	69	72	74	76	78	81	83	85	88	90	92	95	57
58	49	51	53	56	58	61	63	66	68	70	73	75	77	80	82	85	87	89	92	94	96	58
59	50	52	54	57	59	62	64	67	69	72	74	76	79	81	84	86	88	91	93	95	98	59
60	50	53	55	58	60	63	65	68	70	73	75	78	80	83	85	87	90	92	95	97	99	60

Nat. Versines.

(v.)

	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	
0	0060307	0066420	0072816	0079495	0086454	0093692	0101206	0108993	0117052	0125380	0
1	0060407	0066524	0072925	0079609	0086573	0093815	0101333	0109126	0117189	0125521	1
2	60506	66628	73034	79723	86691	93938	01461	09258	17326	25662	2
3	60606	66733	73143	79836	86810	94061	01589	09390	17462	25804	3
4	0060706	0066837	0073253	0079950	0086928	0094185	0101717	0109522	0117599	0125945	4
5	60806	66942	73362	80064	87047	94308	01844	09655	17736	26086	5
6	60906	67046	73471	80178	87166	94431	01972	09787	17873	26228	6
7	0061006	0067151	0073581	0080293	0087285	0094555	0102100	0109920	0118010	0126369	7
8	61106	67256	73690	80407	87403	94678	02228	10052	18147	26511	8
9	61206	67361	73800	80521	87522	94802	02357	10185	18284	26652	9
10	0061306	0067466	0073910	0080636	0087642	0094925	0102485	0110318	0118422	0126794	10
11	61407	67571	74019	80750	87761	95049	02613	10451	18559	26936	11
12	61507	67676	74129	80865	87880	95173	02742	10584	18696	27078	12
13	0061607	0067781	0074239	0080979	0087999	0095297	0102870	0110717	0118834	0127220	13
14	61708	67887	74349	81094	88118	95421	02999	10850	18972	27362	14
15	61809	67992	74459	81209	88238	95545	03127	10983	19109	27504	15
16	0061909	0068098	0074570	0081324	0088357	0095669	0103256	0111116	0119247	0127646	16
17	62010	68203	74680	81439	88477	95793	03365	11249	19385	27788	17
18	62111	68309	74790	81554	88597	95917	03514	11383	19523	27931	18
19	0062212	0068414	0074901	0081669	0088716	0096042	0103642	0111516	0119661	0128073	19
20	62313	68520	75011	81784	88836	96166	03771	11650	19799	28216	20
21	62414	68626	75122	81899	88956	96291	03901	11783	19937	28358	21
22	0062515	0068732	0075232	0082014	0089076	0096415	0104030	0111917	0120075	0128501	22
23	62617	68838	75343	82130	89196	96540	04159	12051	20213	28643	23
24	62718	68944	75454	82245	89316	96665	04288	12185	20351	28786	24
25	0062819	0069050	0075565	0082361	0089436	0096789	0104418	0112318	0120490	0128929	25
26	62921	69157	75676	82477	89557	96914	04547	12452	20628	29072	26
27	63023	69263	75787	82592	89677	97039	04677	12587	20767	29215	27
28	0063124	0069369	0075898	0082708	0089798	0097164	0104806	0112721	0120905	0129358	28
29	63226	69476	76009	82918	89918	97289	04936	12855	21044	29501	29
30	63328	69582	76120	82940	90039	97415	05066	12989	21183	29644	30
31	0063430	0069689	0076232	0083056	0090159	0097540	0105195	0113123	0121322	0129788	31
32	63532	69796	76343	83172	90280	97665	05325	13258	21461	29931	32
33	63634	69903	76455	83288	90401	97791	05455	13392	21600	30074	33
34	0063736	0070009	0076566	0083404	0090522	0097916	0105585	0113527	0121739	0130218	34
35	63838	70116	76678	83521	90643	98042	05716	13662	21878	30361	35
36	63940	70223	76790	83637	90764	98167	05846	13796	22017	30505	36
37	0064043	0070331	0076902	0083754	0090885	0098293	0105976	0113931	0122156	0130649	37
38	64145	70438	77013	83870	91006	98419	06106	14066	22296	30793	38
39	64248	70545	77125	83987	91127	98545	06237	14201	22435	30936	39
40	0064350	0070652	0077238	0084104	0091249	0098671	0106367	0114336	0122575	0131080	40
41	64453	70760	77350	84220	91370	98797	06498	14471	22714	31224	41
42	64556	70867	77462	84337	91492	98923	06629	14606	22854	31368	42
43	0064659	0070975	0077574	0084454	0091613	0099049	0106759	0114742	0122994	0131513	43
44	64762	71083	77687	84571	91735	99175	06890	14877	23133	31657	44
45	64865	71190	77799	84688	91857	99302	07021	15012	23273	31801	45
46	0064968	0071298	0077912	0084806	0091979	0099428	0107152	0115148	0123413	0131946	46
47	65071	71406	78024	84923	92100	99555	07283	15283	23553	32090	47
48	65174	71514	78137	85040	92222	99681	07414	15419	23693	32234	48
49	0065278	0071622	0078250	0085158	0092345	0099808	0107545	0115555	0123883	0132379	49
50	65381	71730	78362	85275	92467	99935	07677	15690	23974	32524	50
51	65485	71839	78475	85393	92589	100061	07808	15826	24114	32669	51
52	0065588	0071947	0078588	0085510	0092711	0100188	0107939	0115962	0124254	0132813	52
53	65692	72055	78701	85628	92833	00315	08071	16098	24395	32958	53
54	65795	72164	78815	85746	92956	00442	08202	16234	24535	33103	54
55	0065899	0072272	0078928	0085864	0093078	0100569	0108334	0116370	0124676	0133248	55
56	66003	72381	79041	85982	93201	00696	08466	16507	24817	33393	56
57	66107	72490	79154	86100	93324	00824	08598	16643	24957	33539	57
58	0066211	0072598	0079268	0086218	0093446	0100951	0108729	0116779	0125098	0133684	58
59	66315	72707	79381	86336	93569	01078	08861	16916	25239	33829	59
60	66420	72816	79495	86454	93692	01206	08993	17052	25380	33975	60

Parts for Seconds.

(v.)

	20°		21°		22°		23°		24°		25°		26°		27°		28°		29°		30°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
2	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2
3	5	5	5	5	5	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	3	3
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5	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	5	5
6	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	15	6	6
7	12	12	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	16	16	17	7	7
8	13	14	14	14	15	15	15	16	16	16	17	17	17	18	18	18	18	19	19	19	8	8
9	15	15	16	16	16	17	17	17	18	18	18	19	19	19	20	20	21	21	21	22	9	9
10	17	17	17	18	18	19	19	19	20	20	21	21	22	22	22	23	23	24	24	24	10	10
11	18	19	19	20	20	21	21	22	22	23	23	23	24	24	25	25	25	26	26	27	11	11
12	20	20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	12	12
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17	28	29	30	30	31	32	32	33	34	34	35	35	36	37	37	38	39	39	40	41	17	17
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21	35	36	36	37	38	39	40	41	41	42	43	44	45	45	46	47	48	49	49	50	21	21
22	36	37	38	39	40	41	42	43	43	44	45	46	47	48	48	49	50	51	52	53	22	22
23	38	39	40	41	42	43	44	44	45	46	47	48	49	50	51	51	52	53	54	55	23	23
24	40	41	42	43	44	45	45	46	47	48	49	50	51	52	53	54	55	56	56	57	24	24
25	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	25	25
26	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	61	26	26
27	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	63	27	27
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29	48	49	50	52	53	54	55	56	57	58	59	61	62	63	64	65	66	67	68	69	29	29
30	50	51	52	53	55	56	57	58	59	60	61	63	64	65	66	67	68	69	71	72	30	30
31	51	53	54	55	56	58	59	60	61	62	64	65	66	67	68	69	71	72	73	74	31	31
32	53	54	56	57	58	59	61	62	63	64	66	67	68	69	70	72	73	74	75	76	32	32
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51	85	87	89	91	93	95	97	99	101	103	105	106	108	110	112	114	116	118	120	122	51	51
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53	88	90	92	94	96	98	100	102	105	107	109	111	113	115	117	119	121	123	125	127	53	53
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55	91	93	96	98	100	102	104	106	108	111	113	115	117	119	121	123	125	127	129	131	55	55
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57	95	97	99	101	104	106	108	110	112	115	117	119	121	123	125	128	130	132	134	136	57	57
58	96	98	101	103	105	108	110	112	114	117	119	121	123	125	128	130	132	134	136	138	58	58
59	98	100	103	105	107	109	112	114	116	119	121	123	125	128	130	131	134	137	139	141	59	59
60	99	102	104	107	109	111	114	116	118	121	123	125	127	130	132	134	136	139	141	143	60	60

Nat. Versines.

(v.)

	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	
0	0133975	0142833	0151952	0161329	0170962	0180848	0190983	0201364	0211989	0222854	0
1	0134120	0142983	0152106	0161488	0171125	0181015	0191154	0201540	0212168	0223037	1
2	34266	43132	52260	61646	71288	81182	91325	01715	12348	23220	2
3	34411	43282	52415	61805	71451	81349	91496	01890	12527	23403	3
4	0134557	0143433	0152569	0161964	0171614	0181516	0191667	0202065	0212706	0223587	4
5	34703	43583	52723	62122	71777	81683	91839	02241	12885	23770	5
6	34849	43733	52878	62281	71940	81850	92010	02416	13065	23954	6
7	0134994	0143883	0153033	0162440	0172103	0182018	0192181	0202592	0213244	0224137	7
8	35140	44034	53187	62599	72266	82185	92353	02767	13424	24321	8
9	35287	44184	53342	62758	72429	82352	92525	02943	13604	24504	9
10	0135433	0144334	0153497	0162917	0172593	0182520	0192696	0203119	0213783	0224688	10
11	35579	44485	53652	63076	72756	82687	92868	03294	13963	24872	11
12	35725	44636	53807	63236	72919	82855	93040	03470	14143	25055	12
13	0135872	0144786	0153962	0163395	0173083	0183023	0193211	0203646	0214323	0225239	13
14	36018	44937	54117	63554	73247	83191	93383	03822	14503	25423	14
15	36164	45088	54272	63714	73410	83358	93555	03998	14683	25607	15
16	0136311	0145239	0154427	0163873	0173574	0183526	0193727	0204174	0214863	0225791	16
17	36458	45390	54583	64033	73738	83694	93899	04350	15043	25976	17
18	36604	45541	54738	64193	73902	83862	94072	04526	15224	26160	18
19	0136751	0145692	0154894	0164352	0174066	0184030	0194244	0204703	0215404	0226344	19
20	36898	45844	55049	64512	74230	84199	94416	04879	15584	26528	20
21	37045	45995	55205	64672	74394	84367	94589	05056	15765	26713	21
22	0137192	0146146	0155360	0164832	0174558	0184535	0194761	0205232	0215945	0226897	22
23	37339	46298	55516	64992	74722	84704	94934	05409	16126	27082	23
24	37486	46449	55672	65152	74886	84872	95106	05585	16306	27266	24
25	0137634	0146601	0155828	0165312	0175051	0185041	0195279	0205762	0216487	0227451	25
26	37781	46752	55984	65473	75215	85209	95452	05939	16668	27636	26
27	37928	46904	56140	65633	75380	85378	95624	06116	16849	27821	27
28	0138076	0147036	0156296	0165793	0175544	0185547	0195797	0206293	0217030	0228005	28
29	38223	47208	56452	65954	75709	85716	95970	06470	17211	28190	29
30	38371	47360	56609	66114	75874	85884	96143	06647	17392	28375	30
31	0138518	0147512	0156765	0166275	0176039	0186053	0196316	0206824	0217573	0228560	31
32	38666	47664	56921	66435	76203	86222	96489	07001	17754	28745	32
33	38814	47816	57078	66596	76368	86392	96662	07178	17935	28931	33
34	0138962	0147968	0157234	0166757	0176533	0186561	0196836	0207355	0218117	0229116	34
35	39110	48121	57391	66918	76698	86730	97009	07533	18298	29301	35
36	39258	48273	57548	67079	76864	86899	97182	07710	18479	29487	36
37	0139406	0148425	0157704	0167240	0177029	0187069	0197356	0207888	0218661	0229672	37
38	39554	48578	57861	67401	77194	87238	97529	08065	18843	29858	38
39	39702	48731	58018	67562	77359	87407	97703	08243	19024	30043	39
40	0139850	0148883	0158175	0167723	0177525	0187577	0197877	0208421	0219206	0230229	40
41	39999	49036	58332	67884	77690	87747	98050	08599	19383	30415	41
42	40148	49189	58489	68046	77856	87916	98224	08776	19570	30600	42
43	0140296	0149342	0158646	0168207	0178022	0188086	0198398	0208954	0219751	0230786	43
44	40445	49495	58804	68369	78187	88256	98572	09132	19933	30972	44
45	40594	49648	58961	68530	78353	88426	98746	09310	20115	31158	45
46	0140742	0149801	0159118	0168692	0178519	0188596	0198920	0209488	0220298	0231344	46
47	40891	49954	59276	68854	78685	88766	99094	09667	20480	31530	47
48	41040	50107	59433	69015	78851	88936	99269	09845	20662	31716	48
49	0141189	0150261	0159591	0169177	0179017	0189106	0199443	0210023	0220844	0231903	49
50	41338	50414	59749	69339	79183	89277	99617	10202	21027	32089	50
51	41487	50567	59906	69501	79349	89447	99792	10380	21209	32275	51
52	0141636	0150721	0160064	0169663	0179515	0189617	0199966	0210559	0221392	0232461	52
53	41786	50875	60222	69825	79682	89788	200141	10737	21574	32648	53
54	41935	51028	60380	69988	79848	89958	00315	10916	21757	32835	54
55	0142084	0151182	0160538	0170150	0180015	0190129	0200490	0211095	0221940	0233021	55
56	42234	51336	60696	70312	80181	90300	00665	11273	22122	33208	56
57	42384	51490	60854	70475	80348	90470	00840	11452	22305	33395	57
58	0142533	0151644	0161013	0170637	0180514	0190641	0201014	0211631	0222438	0233582	58
59	42683	51798	61171	70800	80681	90812	01189	11810	22671	33769	59
60	42833	51952	61329	70962	80848	90983	01364	11989	22854	33956	60

Parts for Seconds.

(v.)

	30°		31°		32°		33°		34°		35°		36°		37°		38°		39°		40°		
	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	
1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	
2	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	2	
3	7	7	7	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	3	
4	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	12	12	12	4	
5	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	15	15	16	5	
6	15	15	15	15	15	16	16	16	16	16	17	17	17	17	18	18	18	18	18	19	19	6	
7	17	17	17	18	18	18	18	19	19	19	20	20	20	20	21	21	21	21	21	22	22	7	
8	19	20	20	20	21	21	21	21	22	22	22	23	23	23	24	24	24	24	24	25	25	8	
9	22	22	22	23	23	23	24	24	24	25	25	25	26	26	26	27	27	27	27	28	28	9	
10	24	25	25	26	26	26	27	27	27	28	28	28	29	29	30	30	30	31	31	31	31	10	
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12	29	30	30	30	31	31	32	32	33	33	33	34	34	35	35	35	36	36	37	37	37	12	
13	32	32	32	33	33	34	34	35	35	36	36	37	37	37	38	38	39	39	40	40	41	13	
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16	39	39	40	41	41	42	42	43	44	44	45	45	46	46	47	47	48	48	49	49	50	16	
17	41	42	42	43	44	44	45	45	46	47	47	48	48	49	50	50	51	51	52	52	53	17	
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19	46	47	47	48	49	49	50	51	52	52	53	53	54	55	55	56	57	57	58	59	59	19	
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24	58	59	60	61	62	63	63	64	65	66	67	68	68	69	70	71	72	72	73	74	75	24	
25	61	62	62	63	64	65	66	67	68	69	70	71	72	73	73	74	75	75	76	77	78	25	
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27	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	81	82	83	84	27	
28	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	84	85	86	87	28	
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30	73	74	75	76	77	78	79	80	82	82	83	84	85	87	88	89	90	91	92	93	93	30	
31	75	76	77	79	80	81	82	83	84	85	86	87	88	89	90	91	93	94	95	96	97	31	
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33	80	81	82	84	85	86	87	88	90	91	92	93	94	95	96	97	98	100	101	102	103	33	
34	82	84	85	86	87	89	90	91	92	93	95	96	97	98	99	100	101	103	104	105	106	34	
35	85	86	87	89	90	91	92	94	95	96	97	99	100	101	102	103	104	106	107	108	109	35	
36	87	89	90	91	92	94	95	96	98	99	100	101	103	104	105	106	107	109	110	111	112	36	
37	90	91	92	94	95	96	98	99	101	102	103	104	105	107	108	109	110	112	113	114	115	37	
38	92	94	95	96	98	99	102	103	104	106	107	108	110	111	112	113	115	116	117	118	119	38	
39	95	96	97	99	100	102	103	104	106	107	108	110	111	112	114	115	116	118	119	120	122	39	
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42	102	103	105	106	108	109	111	112	114	115	117	118	120	121	123	124	125	127	128	130	131	42	
43	104	106	107	109	110	112	114	115	117	118	120	121	123	124	125	127	128	130	131	133	134	43	
44	107	108	110	111	113	115	116	118	120	121	122	124	125	127	128	130	131	133	134	136	137	44	
45	109	111	112	114	116	117	119	120	122	124	125	127	128	130	131	133	134	136	137	139	140	45	
46	112	113	115	117	118	120	121	123	125	126	128	130	131	133	134	136	137	139	140	142	143	46	
47	114	116	117	119	121	122	124	126	128	129	131	132	134	136	137	139	140	142	143	145	146	47	
48	116	118	120	122	123	125	127	128	131	132	133	135	137	138	140	142	143	145	146	148	150	48	
49	119	121	122	124	126	128	129	131	133	135	136	138	140	141	143	145	146	148	149	151	153	49	
50	121	123	125	127	128	130	132	134	136	137	139	141	142	144	146	148	149	151	152	154	156	50	
51	124	126	127	129	131	133	135	136	139	140	142	144	145	147	149	150	152	154	156	157	159	51	
52	126	128	130	132	134	135	137	139	141	143	145	146	148	150	152	153	155	157	159	160	162	52	
53	128	130	132	134	136	138	140	142	144	146	147	149	151	153	155	156	158	160	162	163	165	53	
54	131	133	135	137	139	141	143	144	147	148	150	152	154	156	158	159	161	163	165	167	168	54	
55	133	135	137	139	141	143	145	147	150	151	153	155	157	159	160	162	164	166	168	170	171	55	
56	136	138	140	142	144	146	148	150	152	154	156	158	160	162	163	165	167	169	171	173	174	56	
57	138	140	142	144	146	148	151	153	155	157	159	160	162	164	166	168	170	172	174	176	178	57	
58	141	143	145	147	149	151	153	155	158	159	161	163	165	167	169	171	173	175	177	179	181	58	
59	143	145	147	150	152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182	184	59	
60	145	148	150	152	154	156	158	161	163	165	167	169	171	173	175	177	179	181	183	185	187	60	

Nat. Versines.

(v.)

	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	
0	0233956	0245290	0256855	0268646	0280660	0292893	0305342	0318002	0330869	0343941	0
1	0234143	0245481	0257050	0268845	0280862	0293099	0305551	0318214	0331086	0344160	1
2	34330	45672	57245	69043	81064	93305	05760	18427	31302	44380	2
3	34517	45863	57439	69242	81267	93511	05970	18640	31518	44600	3
4	0234704	0246054	0257634	0269440	0281469	0293716	0306179	0318853	0331734	0344820	4
5	34891	46245	57829	69639	81671	93922	06389	19066	31951	45039	5
6	35079	46437	58024	69838	81874	94128	06598	19279	32167	45259	6
7	0235266	0246628	0258219	0270036	0282076	0294334	0306808	0319492	0332384	0345479	7
8	35453	46819	58414	70235	82279	94541	07017	19705	32601	45699	8
9	35641	47011	58609	70434	82481	94747	07227	19919	32817	45919	9
10	0235829	0247202	0258805	0270633	0282684	0294953	0307437	0320132	0333034	0346139	10
11	36016	47393	59000	70832	82887	95159	07647	20345	33251	46359	11
12	36204	47585	59195	71031	83089	95366	07857	20559	33467	46579	12
13	0236392	0247777	0259391	0271230	0283292	0295572	0308067	0320772	0333684	0346800	13
14	36580	47968	59586	71430	83495	95779	08277	20986	33901	47020	14
15	36767	48160	59782	71629	83698	95985	08487	21199	34118	47240	15
16	0236955	0248352	0259977	0271828	0283901	0296192	0308697	0321413	0334335	0347461	16
17	37144	48544	60173	72028	84104	96399	08907	21627	34552	47681	17
18	37332	48736	60369	72227	84307	96605	09118	21840	34770	47902	18
19	0237520	0248928	0260565	0272427	0284510	0296812	0309328	0322054	0334987	0348122	19
20	37708	49120	60761	72626	84714	97019	09538	22268	35204	48343	20
21	37896	49312	60956	72826	84917	97226	09749	22482	35421	48563	21
22	0238085	0249504	0261152	0273026	0285120	0297433	0309959	0322696	0335639	0348784	22
23	38273	49697	61348	73225	85324	97640	10170	22910	35856	49005	23
24	38462	49889	61545	73425	85527	97847	10380	23124	36074	49226	24
25	0238650	0250081	0261741	0273625	0285731	0298054	0310591	0323338	0336291	0349447	25
26	38839	50274	61937	73825	85934	98261	10802	23552	36509	49668	26
27	39028	50466	62133	74025	86138	98469	11013	23767	36727	49889	27
28	0239216	0250659	0262330	0274225	0286342	0298676	0311223	0323981	0336944	0350110	28
29	39405	50852	62526	74425	86546	98883	11434	24195	37162	50331	29
30	39594	51044	62723	74626	86750	99091	11645	24410	37380	50552	30
31	0239783	0251237	0262919	0274826	0286953	0299298	0311856	0324624	0337598	0350773	31
32	39972	51430	63116	75026	87157	99506	12067	24839	37816	50994	32
33	40161	51623	63312	75227	87361	99713	12279	25053	38034	51216	33
34	0240350	0251816	0263509	0275427	0287566	0299921	0312490	0325268	0338252	0351437	34
35	40539	52009	63706	75628	87770	300129	12701	25483	38470	51659	35
36	40729	52202	63903	75828	87974	00337	12912	25698	38688	51880	36
37	0240918	0252395	0264100	0276029	0288178	0300544	0313124	0325912	0338906	0352102	37
38	41107	52588	64297	76229	88383	00752	13335	26127	39125	52323	38
39	41297	52782	64494	76430	88587	00960	13547	26342	39343	52545	39
40	0241486	0252975	0264691	0276631	0288791	0301168	0313758	0326557	0339561	0352767	40
41	41676	53168	64888	76832	88996	01377	13970	26772	39780	52988	41
42	41866	53362	65085	77033	89200	01585	14182	26987	39998	53210	42
43	0242055	0253555	0265283	0277234	0289405	0301793	0314393	0327203	0340217	0353432	43
44	42245	53749	65480	77435	89610	02001	14605	27418	40435	53654	44
45	42435	53943	65677	77636	89815	02209	14817	27633	40654	53876	45
46	0242625	0254136	0265875	0277837	0290019	0302418	0315029	0327848	0340873	0354093	46
47	42815	54330	66072	78038	90224	02626	15241	28064	41092	54320	47
48	43005	54524	66270	78240	90429	02835	15453	28279	41310	54542	48
49	0243195	0254718	0266468	0278441	0290634	0303043	0315665	0328495	0341529	0354764	49
50	43385	54912	66665	78643	90839	03252	15877	28710	41748	54987	50
51	43575	55106	66863	78844	91044	03461	16089	28926	41967	55209	51
52	0243766	0255300	0267061	0279046	0291250	0303669	0316302	0329142	0342186	0355431	52
53	43956	55494	67259	79247	91455	03378	16514	29358	42406	55654	53
54	44146	55688	67457	79449	91660	04087	16726	29573	42625	55876	54
55	0244337	0255883	0267655	0279651	0291865	0304296	0316939	0329789	0342844	0356099	55
56	44528	56077	67853	79852	92071	04505	17151	30005	43063	56321	56
57	44718	56271	68051	80054	92276	04714	17364	30221	43283	56544	57
58	0244909	0256466	0268250	0280256	0292482	0304923	0317576	0330437	0343502	0356767	58
59	45100	56661	68448	80458	92688	05132	17789	30653	43721	56990	59
60	45290	56855	68646	80660	92893	05342	18002	30869	43941	57212	60

Parts for Seconds.

(v.)

	40°		41°		42°		43°		44°		45°		46°		47°		48°		49°		50°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
1	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	1
2	6	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	2
3	9	9	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	3
4	12	13	13	13	13	13	13	13	14	14	14	14	14	14	14	14	14	15	15	15	15	4
5	16	16	16	16	16	16	17	17	17	17	17	17	18	18	18	18	18	18	18	18	19	5
6	19	19	19	19	19	20	20	20	20	20	21	21	21	21	21	21	22	22	22	22	22	6
7	22	22	22	22	23	23	23	23	24	24	24	24	24	25	25	25	25	25	26	26	26	7
8	25	25	25	26	26	26	26	27	27	27	27	28	28	28	29	29	29	29	29	29	30	8
9	28	28	29	29	29	29	30	30	30	31	31	31	31	32	32	32	32	33	33	33	33	9
10	31	31	32	32	32	33	33	33	34	34	34	35	35	35	35	36	36	36	37	37	37	10
11	34	35	35	35	36	36	36	37	37	37	38	38	38	39	39	39	40	40	40	41	41	11
12	37	38	38	39	39	39	40	40	40	41	41	41	42	42	43	43	43	44	44	44	45	12
13	41	41	41	42	42	43	43	43	44	44	45	45	45	46	46	46	47	47	48	48	48	13
14	44	44	45	45	45	46	46	47	47	47	48	48	49	49	50	50	50	51	51	52	52	14
15	47	47	48	48	49	49	50	50	51	51	51	52	52	53	53	54	54	54	55	55	56	15
16	50	50	51	51	52	52	53	53	54	54	55	55	56	56	57	57	58	58	59	59	59	16
17	53	54	54	55	55	56	56	57	57	58	58	59	59	60	60	61	61	62	62	63	63	17
18	56	57	57	58	58	59	60	60	61	61	62	62	63	63	64	64	65	65	66	66	67	18
19	59	60	60	61	62	62	63	63	64	65	65	66	66	67	67	68	68	69	70	70	71	19
20	62	63	64	64	65	65	66	67	67	68	69	69	70	70	71	71	72	73	73	74	74	20
21	65	66	67	67	68	69	69	70	71	71	72	73	73	74	74	75	76	76	77	77	78	21
22	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	80	81	82	22
23	72	72	73	74	75	75	76	77	77	78	79	80	80	81	82	82	83	84	84	85	85	23
24	75	76	76	77	78	79	79	80	81	82	82	83	84	84	85	86	86	87	88	88	89	24
25	78	79	80	80	81	82	83	83	84	85	86	86	87	88	89	90	90	91	91	92	93	25
26	81	82	83	84	84	85	86	87	87	88	89	90	91	91	92	93	94	94	95	96	97	26
27	84	85	86	87	88	88	89	90	91	92	92	93	94	95	96	97	97	98	99	100	100	27
28	87	88	89	90	91	92	93	93	94	96	96	97	98	98	99	100	101	102	102	103	104	28
29	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	104	105	106	107	108	109	29
30	93	94	95	96	97	98	99	100	101	102	103	104	105	105	106	107	108	109	110	111	111	30
31	97	98	99	100	101	102	103	103	104	105	106	107	108	109	110	111	112	113	113	114	115	31
32	100	101	102	103	104	105	106	107	108	109	110	111	112	113	113	114	115	116	117	118	119	32
33	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	33
34	106	107	108	109	110	111	112	113	114	116	117	118	119	120	121	121	123	123	124	125	126	34
35	109	110	111	112	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	35
36	112	113	115	116	117	118	119	120	121	122	123	124	126	127	128	129	130	131	132	133	134	36
37	115	117	118	119	120	121	122	123	125	126	127	128	129	130	131	132	133	134	135	136	137	37
38	118	120	121	122	123	124	126	127	128	129	130	131	133	134	135	136	137	138	139	140	141	38
39	122	123	124	125	126	128	129	130	131	132	134	135	136	137	138	139	141	142	143	144	145	39
40	125	126	127	128	130	131	132	133	135	136	137	138	139	141	142	143	144	145	146	147	149	40
41	128	129	130	132	133	134	136	137	138	139	141	142	143	144	145	147	148	149	150	151	152	41
42	131	132	134	135	136	138	139	140	141	143	144	145	146	148	149	150	151	152	154	155	156	42
43	134	135	137	138	139	141	142	144	145	146	147	149	150	151	152	154	155	156	157	159	160	43
44	137	139	140	141	143	144	145	147	148	150	151	152	153	155	156	157	159	160	161	162	163	44
45	140	142	143	145	146	147	149	150	152	153	154	156	157	156	160	161	162	163	165	166	167	45
46	143	145	146	148	149	151	152	154	155	156	158	159	160	162	163	164	166	167	168	170	171	46
47	146	148	150	151	152	154	155	157	158	160	161	163	164	165	167	168	169	171	172	173	175	47
48	150	151	153	154	156	157	159	160	162	163	165	166	167	169	170	172	173	174	176	177	178	48
49	153	154	156	157	159	160	162	164	165	167	168	169	171	172	174	175	177	178	179	181	182	49
50	156	157	160	161	162	164	165	167	168	170	171	173	174	176	177	179	180	182	183	184	186	50
51	159	161	162	164	165	167	169	170	172	173	175	176	178	179	181	182	184	185	187	188	189	51
52	162	164	165	167	169	170	172	174	175	177	178	180	181	183	184	186	187	189	190	192	193	52
53	165	167	169	170	172	174	175	177	178	180	182	183	185	186	188	189	191	192	194	195	197	53
54	168	170	172	173	175	177	179	180	182	184	185	187	188	190	191	193	195	196	198	199	201	54
55	171	173	175	177	178	180	182	184	185	187	189	190	192	193	195	197	198	200	201	203	204	55
56	174	176	178	180	182	183	185	187	189	190	192	194	195	197	199	200	202	203	205	206	208	56
57	178	180	181	183	185	187	188	190	192	194	195	197	199	200	202	204	205	207	209	210	212	57
58	181	183	184	186	188	190	192	194	195	197	199	200	202	204	206	207	209	211	213	214	215	58
59	184	186	188	190	191	193	195	197	199	201	202	204	206	207	209	211	213	214	216	218	219	59
60	187	189	190	193	195	196	198	200	202	204	206	207	209	211	213	214	216	219	219	221	223	60

Nat. Versines.

(v.)

	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	
0	0357212	0370680	0384338	0398185	0412215	0426424	0440807	0455361	0470081	0484962	0
1	0357435	0370906	0384568	0398417	0412450	0426662	0441048	0455605	0470327	0485211	1
2	57658	71132	84797	98650	12685	26900	41289	55849	70574	85461	2
3	57881	71358	85026	98882	12921	27139	41531	56093	70821	85710	3
4	0358104	0371584	0385256	0399115	0413156	0427377	0441772	0456337	0471068	0485960	4
5	58327	71811	85485	99347	13392	27616	42013	56581	71315	86209	5
6	58550	72037	85715	99580	13628	27854	42255	56826	71562	86459	6
7	0358774	0372263	0385944	0399812	0413863	0428093	0442496	0457070	0471809	0486708	7
8	58997	72490	86174	400045	14099	28331	42738	57314	72056	86958	8
9	59220	72716	86404	00278	14335	28570	42979	57558	72303	87208	9
10	0359443	0372943	0386633	0400511	0414571	0428809	0443221	0457803	0472550	0487457	10
11	59667	73169	86863	00743	14806	29048	43463	58047	72797	87707	11
12	59890	73396	87093	00976	15042	29286	43704	58292	73044	87957	12
13	0360114	0373623	0387323	0401209	0415278	0429525	0443946	0458536	0473291	0488207	13
14	60337	73850	87553	01442	15514	29764	44188	58781	73539	88457	14
15	60561	74076	87783	01675	15750	30003	44430	59025	73786	88707	15
16	0360785	0374303	0388013	0401908	0415986	0430242	0444672	0459270	0474033	0488957	16
17	61008	74530	88243	02142	16223	30481	44914	59515	74281	89207	17
18	61232	74757	88473	02375	16459	30720	45156	59760	74528	89457	18
19	0361456	0374984	0388703	0402608	0416695	0430960	0445398	0460004	0474776	0489707	19
20	61680	75211	88933	02841	16931	31199	45640	60249	75023	89957	20
21	61904	75439	89164	03075	17168	31438	45882	60494	75271	90208	21
22	0362128	0375666	0389394	0403308	0417404	0431677	0446124	0460739	0475519	0490458	22
23	62352	75893	89624	03542	17640	31917	46366	60984	75766	90708	23
24	62576	76120	89855	03775	17877	32156	46608	61229	76014	90959	24
25	0362800	0376348	0390085	0404009	0418114	0432396	0446851	0461474	0476262	0491209	25
26	63024	76575	90316	04242	18350	32635	47093	61719	76510	91459	26
27	63249	76803	90546	04476	18587	32875	47335	61955	76758	91710	27
28	0363473	0377030	0390777	0404710	0418823	0433114	0447578	0462210	0477005	0491960	28
29	63697	77258	91008	04943	19060	33354	47820	62455	77253	92211	29
30	63922	77485	91239	05177	19297	33594	48053	62700	77501	92462	30
31	0364146	0377713	0391469	0405411	0419534	0433833	0448306	0462946	0477749	0492712	31
32	64367	77941	91700	05645	19771	34073	48548	63191	77998	92963	32
33	64595	78169	91931	05879	20008	34313	48791	63437	78246	93214	33
34	0364820	0378396	0392162	0406113	0420245	0434553	0449034	0463682	0478494	0493464	34
35	65045	78624	92393	06347	20482	34798	49276	63928	78742	93715	35
36	65269	78852	92624	06581	20719	35033	49519	64173	78990	93966	36
37	0365494	0379080	0392855	0406815	0420956	0435273	0449762	0464419	0479239	0494217	37
38	65719	79308	93086	07049	21193	35513	50005	64664	79487	94468	38
39	65944	79536	93318	07284	21430	35753	50248	64910	79735	94719	39
40	0366169	0379764	0393549	0407518	0421668	0435993	0450491	0465156	0479984	0494970	40
41	66394	79993	93780	07752	21905	36234	50734	65402	80232	95221	41
42	66619	80221	94012	07987	22142	36474	50977	65648	80481	95472	42
43	0366844	0380449	0394243	0408221	0422380	0436714	0451220	0465893	0480729	0495723	43
44	67069	80678	94474	08456	22617	36955	51463	66139	80978	95975	44
45	67295	80906	94706	08690	22855	37195	51707	66385	81227	96226	45
46	0367520	0381134	0394938	0408925	0423092	0437435	0451950	0466631	0481475	0496477	46
47	67745	81363	95169	09160	23330	37676	52193	66878	81724	96729	47
48	67971	81592	95401	09394	23568	37917	52437	67124	81973	96980	48
49	0368196	0381820	0395633	0409629	0423805	0438157	0452680	0467370	0482222	0497231	49
50	68422	82049	95864	09864	24043	38398	52924	67616	82471	97483	50
51	68647	82278	96096	10099	24281	38639	53167	67862	82720	97734	51
52	0368873	0382506	0396328	0410334	0424519	0438879	0453411	0468109	0482969	0497986	52
53	69098	82735	96560	10569	24757	39120	53654	68355	83218	98238	53
54	69324	82964	96792	10804	24995	39361	53898	68601	83467	98489	54
55	0369550	0383193	0397024	0411039	0425233	0439602	0454142	0468848	0483716	0498741	55
56	69776	83422	97256	11274	25471	39843	54385	69094	83965	98993	56
57	70002	83651	97488	11509	25709	40084	54629	69341	84214	99244	57
58	0370228	0383880	0397720	0411744	0425947	0440325	0454873	0469587	0484463	0499496	58
59	70454	84109	97953	11979	26185	40566	55117	69834	84713	99744	59
60	70680	84338	98185	12215	26424	40807	55361	70081	84962	500000	60

Parts for Seconds.

(v.)

	50°		51°		52°		53°		54°		55°		56°		57°		58°		59°		60°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'
1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1
2	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2
3	11	11	11	11	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	13	13	3
4	15	15	15	15	15	15	15	16	16	16	16	16	16	16	16	16	16	17	17	17	17	4
5	19	19	19	19	19	19	19	19	20	20	20	20	20	20	20	20	21	21	21	21	21	5
6	22	22	23	23	23	23	23	23	24	24	24	24	24	24	24	25	25	25	25	25	25	6
7	26	26	26	27	27	27	27	27	27	28	28	28	28	28	28	29	29	29	29	29	29	7
8	30	30	30	30	31	31	31	31	31	32	32	32	32	32	32	33	33	33	33	33	34	8
9	33	34	34	34	34	35	35	35	35	36	36	36	36	36	37	37	37	37	37	38	38	9
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13	48	49	49	49	50	50	50	51	51	51	52	52	52	53	53	53	53	54	54	54	55	13
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16	59	60	60	61	61	62	62	62	63	63	64	64	64	65	65	65	66	66	66	67	67	16
17	63	64	64	64	65	65	66	66	67	67	68	68	68	69	69	70	70	70	71	71	71	17
18	67	67	68	68	69	69	70	70	71	71	71	72	72	73	73	74	74	74	75	75	76	18
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24	89	90	90	91	92	92	93	94	94	95	95	96	96	97	98	98	99	99	100	100	101	24
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27	100	101	102	102	103	104	105	105	106	107	107	108	109	109	110	110	111	112	112	113	113	27
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30	111	112	113	114	115	115	116	117	118	119	120	121	121	122	123	123	124	125	125	126	126	30
31	115	116	117	118	118	119	120	121	122	122	123	124	125	125	126	127	127	128	129	130	130	31
32	119	120	120	121	122	123	124	125	126	126	127	128	129	129	130	131	132	132	133	134	134	32
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37	137	139	139	140	141	142	143	144	145	146	147	148	149	150	150	151	152	153	154	155	155	37
38	141	142	143	144	145	146	147	148	149	150	151	152	153	154	154	155	156	157	158	159	160	38
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40	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	164	165	166	167	168	40
41	152	153	154	156	157	158	159	160	161	162	163	164	165	166	167	168	169	169	170	171	172	41
42	156	157	158	159	160	162	163	164	165	166	167	168	169	170	171	172	173	174	175	175	176	42
43	160	161	162	163	164	165	166	168	169	170	171	172	173	174	175	176	177	178	179	180	181	43
44	163	165	166	167	168	169	170	171	173	174	175	176	177	178	179	180	181	182	183	184	185	44
45	167	168	170	171	172	173	174	175	177	178	179	180	181	182	183	184	185	186	187	188	189	45
46	171	172	173	175	176	177	178	179	180	182	183	184	185	186	187	188	189	191	191	192	193	46
47	175	176	177	178	180	181	182	183	184	185	187	188	189	190	191	192	193	194	195	196	197	47
48	178	180	181	182	183	185	186	187	188	190	191	192	193	194	195	196	197	198	199	201	202	48
49	182	183	185	186	187	188	190	191	192	193	195	196	197	198	199	200	201	203	204	205	206	49
50	186	187	188	190	191	192	194	195	196	197	199	200	201	202	203	204	206	207	208	209	210	50
51	189	191	192	194	195	196	197	199	200	201	203	204	205	206	207	209	210	211	212	213	214	51
52	193	195	196	197	199	200	201	203	204	205	207	208	209	210	211	213	214	215	216	217	218	52
53	197	198	200	201	203	204	205	207	208	209	210	212	213	214	215	217	218	219	220	221	223	53
54	201	202	203	205	206	208	209	210	212	213	214	216	217	218	220	221	222	223	224	226	227	54
55	204	206	207	209	210	212	213	214	216	217	218	220	221	222	224	225	226	227	229	230	231	55
56	208	209	211	212	214	215	217	218	220	221	222	224	225	226	228	229	230	232	233	234	235	56
57	212	213	215	216	218	219	221	222	224	225	226	228	229	230	232	233	234	236	237	238	239	57
58	215	217	219	220	222	223	225	226	228	229	230	232	233	234	236	237	238	240	241	242	244	58
59	219	221	222	224	225	227	228	230	231	233	234	236	237	239	240	241	243	244	245	246	248	59
60	223	224	226	228	229	231	232	234	235	237	238	240	241	243	244	245	247	248	249	251	252	60

(v.)

Nat. Versines.

	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	
0	0500000	0515190	0530528	0546009	0561629	0577382	0593263	0609269	0625393	0641632	0
1	0500252	0515445	0530785	0546269	0561890	0577645	0593529	0609537	0625663	0641904	1
2	00504	15699	31042	46528	62152	77909	93795	09804	25933	42175	2
3	00756	15954	31299	46787	62413	78173	94061	10072	26203	42447	3
4	0501008	0516208	0531556	0547046	0562675	0578437	0594327	0610340	0626472	0642719	4
5	01260	16463	31813	47306	62937	78700	94592	10608	26742	42990	5
6	01512	16718	32070	47565	63198	78964	94858	10876	27012	43262	6
7	0501764	0516972	0532327	0547825	0563460	0579228	0595124	0611144	0627282	0643534	7
8	02017	17227	32584	48084	63722	79492	95390	11412	27552	43806	8
9	02269	17482	32842	48344	63983	79756	95656	11680	27822	44077	9
10	0502521	0517737	0533099	0548603	0564245	0580020	0595922	0611948	0628092	0644349	10
11	02774	17991	33356	48863	64507	80284	96189	12216	28362	44621	11
12	03026	18246	33613	49122	64769	80548	96455	12484	28632	44893	12
13	0503278	0518501	0533871	0549382	0565031	0580812	0596721	0612753	0628902	0645165	13
14	03531	18756	34128	49642	65293	81076	96987	13021	29172	45437	14
15	03783	19011	34385	49902	65555	81340	97253	13289	29443	45709	15
16	0504036	0519266	0534043	0550161	0565817	0581604	0597520	0613557	0629713	0645981	16
17	04289	19521	34900	50421	66079	81869	97786	13826	29983	46253	17
18	04541	19776	35158	50681	66341	82133	98052	14094	30253	46525	18
19	0504794	0520032	0535415	0550941	0566603	0582397	0598319	0614362	0630523	0646797	19
20	05047	20287	35673	51201	66865	82661	98585	14631	30794	47069	20
21	05299	20542	35931	51461	67127	82926	98851	14899	31064	47342	21
22	0505552	0520797	0536188	0551721	0567390	0583190	0599118	0615168	0631335	0647614	22
23	05805	21053	36446	51981	67652	83455	99384	15436	31605	47886	23
24	06058	21308	36704	52241	67914	83719	99651	15705	31875	48158	24
25	0506311	0521564	0536962	0552501	0568177	0583984	0599917	0615973	0632146	0648431	25
26	06564	21819	37220	52761	68439	84248	600184	16242	32416	48703	26
27	06817	22074	37477	53021	68701	84513	600451	16510	32687	48975	27
28	0507070	0522330	0537735	0553282	0568964	0584777	0600717	0616779	0632957	0649248	28
29	07323	22586	37993	53542	69226	85042	600984	17048	33228	49520	29
30	07576	22841	38251	53802	69489	85307	601251	17317	33499	49793	30
31	0507830	0523097	0538509	0554062	0569751	0585571	0601518	0617585	0633769	0650065	31
32	08083	23353	38767	54323	70014	85836	601784	17854	34040	50338	32
33	08336	23608	39026	54583	70277	86101	602051	18123	34311	50610	33
34	0508589	0523864	0539284	0554844	0570539	0586366	0602318	0618392	0634582	0650883	34
35	08843	24120	39542	55104	70802	86631	602585	18661	34852	51155	35
36	09096	24376	39800	55365	71065	86896	602852	18930	35123	51428	36
37	0509350	0524632	0540058	0555625	0571328	0587160	0603119	0619199	0635394	0651701	37
38	09603	24888	40317	55886	71590	87425	603386	19468	35665	51973	38
39	09857	25144	40575	56147	71853	87690	603653	19737	35936	52246	39
40	0510110	0525400	0540833	0556407	0572116	0587955	0603920	0620006	0636207	0652519	40
41	10364	25656	41092	56668	72379	88220	604187	20275	36478	52791	41
42	10617	25912	41350	56929	72642	88486	604454	20544	36749	53064	42
43	0510871	0526168	0541609	0557190	0572905	0588751	0604722	0620813	0637020	0653337	43
44	11125	26424	41867	57450	73168	89016	604989	21082	37291	53610	44
45	11379	26690	42126	57711	73431	89281	605256	21351	37562	53883	45
46	0511633	0526937	0542385	0557972	0573694	0589546	0605523	0621621	0637833	0654156	46
47	11886	27193	42643	58233	73957	89812	605791	21890	38104	54229	47
48	12140	27449	42902	58494	74221	90077	606058	22159	38375	54702	48
49	0512394	0527706	0543161	0558755	0574484	0590342	0606325	0622429	0638647	0654975	49
50	12648	27962	43420	59016	74747	90608	606593	22698	38918	55248	50
51	12902	28218	43678	59277	75010	90873	606860	22967	39189	55521	51
52	0513156	0528475	0543937	0559538	0575274	0591138	0607128	0623237	0639460	0655794	52
53	13410	28731	44196	59800	75537	91404	607395	23506	39732	56067	53
54	13665	28988	44455	60061	75801	91669	607663	23776	40003	56340	54
55	0513919	0529245	0544714	0560322	0576064	0591935	0607930	0624045	0640275	0656613	55
56	14173	29501	44973	60583	76327	92201	608198	24315	40546	56887	56
57	14427	29758	45232	60845	76591	92466	608466	24584	40817	57160	57
58	0514682	0530015	0545491	0561106	0576854	0592732	0608733	0624854	0641089	0657433	58
59	14936	30272	45750	61367	77118	92998	609001	25124	41360	57706	59
60	15190	30528	46009	61629	77382	93263	609269	25393	41632	57980	60

Parts for Seconds.

(v.)

"	60°		61°		62°		63°		64°		65°		66°		67°		68°		69°		70°		"
	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	
1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	1	1
2	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	2	2
3	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	14	14	14	14	3	3
4	17	17	17	17	17	17	17	17	18	18	18	18	18	18	18	18	18	18	18	18	18	4	4
5	21	21	21	21	21	21	22	22	22	22	22	22	22	22	22	22	22	23	23	23	23	5	5
6	25	25	25	26	26	26	26	26	26	26	26	26	27	27	27	27	27	27	27	27	27	6	6
7	29	30	30	30	30	30	30	30	31	31	31	31	31	31	31	31	31	32	32	32	32	7	7
8	34	34	34	34	34	34	35	35	35	35	35	35	35	36	36	36	36	36	36	36	36	8	8
9	38	38	38	38	39	39	39	39	39	39	39	40	40	40	40	40	40	41	41	41	41	9	9
10	42	42	42	43	43	43	43	43	44	44	44	44	44	44	45	45	45	45	45	45	46	10	10
11	46	46	47	47	47	47	48	48	48	48	48	49	49	49	49	49	49	50	50	50	50	11	11
12	50	51	51	51	51	52	52	52	52	53	53	53	53	53	54	54	54	54	54	54	55	12	12
13	55	55	55	55	56	56	56	56	57	57	57	57	58	58	58	58	58	59	59	59	59	13	13
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16	67	68	68	68	68	69	69	69	70	70	70	71	71	71	72	72	72	72	72	73	73	16	16
17	71	72	72	72	73	73	73	74	74	74	75	75	75	76	76	76	76	77	77	77	77	17	17
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19	80	80	81	81	81	82	82	82	83	83	83	84	84	84	85	85	85	86	86	86	87	19	19
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22	92	93	93	94	94	95	95	95	96	96	97	97	97	98	98	99	99	99	100	100	100	22	22
23	97	97	98	98	98	99	99	100	100	101	101	101	102	102	103	103	103	104	104	104	105	23	23
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34	143	143	144	145	146	146	147	148	148	149	149	150	151	151	152	152	153	153	154	154	155	34	34
35	147	148	148	150	150	150	151	152	153	153	154	154	155	156	156	157	157	158	158	159	159	35	35
36	151	152	153	153	154	155	156	156	157	158	158	159	159	160	161	161	162	162	163	163	164	36	36
37	155	156	157	158	158	159	160	161	161	162	163	163	164	164	165	166	166	167	167	168	169	37	37
38	160	160	161	162	163	163	164	165	166	166	167	168	168	169	170	170	171	171	172	173	173	38	38
39	164	165	165	166	167	168	168	169	170	171	171	172	173	173	174	175	175	176	177	177	178	39	39
40	168	169	170	170	171	172	173	174	174	175	176	176	177	178	179	179	180	180	181	182	182	40	40
41	172	173	174	175	176	176	177	178	179	179	180	181	182	182	183	184	184	185	186	186	187	41	41
42	176	177	178	179	180	181	181	182	183	184	185	185	186	187	187	188	189	189	190	191	191	42	42
43	181	181	182	183	184	185	186	187	187	188	189	190	190	191	192	193	193	194	195	195	196	43	43
44	185	186	187	187	188	189	190	191	192	193	193	194	195	196	197	197	198	198	199	200	200	44	44
45	189	190	191	192	193	193	194	195	196	197	198	199	199	200	201	201	202	203	204	204	205	45	45
46	193	194	195	196	197	198	199	200	200	201	202	203	204	205	205	206	207	207	208	209	210	46	46
47	197	198	199	200	201	202	203	204	205	206	207	207	208	209	210	211	211	212	213	213	214	47	47
48	202	203	204	205	205	206	207	208	209	210	211	212	213	213	214	215	216	217	217	218	219	48	48
49	206	207	208	209	210	211	212	213	214	214	215	216	217	218	219	220	220	221	222	222	223	49	49
50	210	211	212	213	214	215	216	217	218	219	220	221	221	222	223	224	225	226	226	227	228	50	50
51	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	228	229	230	231	232	232	51	51
52	218	219	220	221	223	224	225	226	227	228	228	229	230	231	232	233	234	235	235	236	237	52	52
53	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	237	238	239	240	241	241	53	53
54	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	244	245	246	54	54
55	231	232	233	234	235	236	238	239	240	241	242	243	244	245	245	246	247	248	249	250	251	55	55
56	235	236	237	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	253	254	255	56	56
57	239	240	242	243	244	245	246	247	249	249	250	251	252	253	254	255	256	257	258	259	260	57	57
58	244	245	246	247	248	249	251	252	253	254	255	256	257	258	259	260	261	262	262	263	264	58	58
59	248	249	250	251	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	59	59
60	252	253	254	256	257	258	259	260	261	263	264	265	266	267	268	269	270	271	272	272	273	60	60

(v.)

Nat. Versines.

	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	
0	0657980	0674432	0690983	0707628	0724363	0741181	0758078	0775049	0792088	0809191	0
1	0658253	0674707	0691260	0707906	0724642	0741462	0758360	0775332	0792373	0809477	1
2	58527	74982	91536	08185	24922	41743	58643	75616	92657	09762	2
3	58800	75257	91813	08463	25202	42024	58925	75899	92942	10048	3
4	0659073	0675532	0692090	0708741	0725481	0742305	0759207	0776183	0793227	0810333	4
5	59347	75807	92367	09019	25761	42586	59490	76466	93511	10619	5
6	59620	76083	92643	09298	26041	42867	59772	76750	93796	10905	6
7	0659894	0676358	0692920	0709576	0726321	0743148	0760054	0777033	0794080	0811190	7
8	60167	76633	93197	09854	26600	43429	60337	77317	94365	11476	8
9	60441	76908	93474	10133	26880	43711	60619	77601	94650	11761	9
10	0660715	0677184	0693751	0710411	0727160	0743992	0760902	0777884	0794934	0812047	10
11	60988	77459	94028	10690	27440	44273	61184	78168	95219	12333	11
12	61262	77734	94305	10968	27720	44554	61466	78451	95504	12619	12
13	0661536	0678010	0694582	0711247	0728000	0744835	0761749	0778735	0795789	0812904	13
14	61809	78285	94859	11525	28280	45117	62032	79019	96073	13190	14
15	62083	78560	95136	11804	28560	45398	62314	79303	96358	13476	15
16	0662357	0678836	0695413	0712082	0728839	0745679	0762597	0779586	0796643	0813762	16
17	62631	79111	95690	12361	29119	45961	62879	79870	96928	14048	17
18	62905	79387	95967	12639	29400	46242	63162	80154	97213	14333	18
19	0663179	0679663	0696244	0712918	0729680	0746523	0763444	0780438	0797498	0814619	19
20	63452	79938	96521	13197	29960	46805	63727	80721	97782	14905	20
21	63726	80214	96798	13475	30240	47086	64010	81005	98067	15191	21
22	0664000	0680489	0697076	0713754	0730520	0747368	0764292	0781289	0798352	0815477	22
23	64274	80765	97353	14033	30800	47649	64575	81573	98637	15763	23
24	64548	81041	97630	14312	31080	47931	64858	81857	98922	16049	24
25	0664822	0681316	0697907	0714590	0731360	0748212	0765141	0782141	0799207	0816335	25
26	65097	81592	98185	14869	31641	48494	65423	82425	99492	16620	26
27	65371	81868	98462	15148	31921	48775	65706	82708	99777	16906	27
28	0665645	0682144	0698739	0715427	0732201	0749057	0765989	0782992	0800062	0817192	28
29	65919	82419	99017	15706	32481	49338	66272	83276	00347	17478	29
30	66193	82695	99294	15985	32762	49620	66555	83560	00632	17764	30
31	0666467	0682971	0699572	0716264	0733042	0749902	0766837	0783844	0800917	0818050	31
32	66742	83247	99849	16542	33322	50183	67120	84128	01202	18336	32
33	67016	83523	700127	16821	33603	50465	67403	84412	01487	18623	33
34	0667290	0683799	0700404	0717100	0733883	0750747	0767686	0784696	0801772	0818909	34
35	67564	84075	00682	17379	34163	51028	67969	84981	02057	19195	35
36	67839	84351	00959	17658	34444	51310	68252	85265	02343	19481	36
37	0668113	0684627	0701237	0717938	0734724	0751592	0768535	0785549	0802628	0819767	37
38	68388	84903	01514	18217	35005	51874	68818	85833	02913	20053	38
39	68662	85179	01792	18496	35285	52155	69101	86117	03198	20339	39
40	0668937	0685455	0702070	0718775	0735566	0752437	0769384	0786401	0803483	0820625	40
41	69211	85731	02347	19054	35846	52719	69667	86685	03769	20912	41
42	69486	86007	02625	19333	36127	53001	69950	86970	04054	21198	42
43	0669760	0686284	0702903	0719612	0736407	0753283	0770233	0787254	0804339	0821484	43
44	70035	86560	03181	19892	36688	53565	70516	87538	04624	21770	44
45	70309	86836	03458	20171	36969	53847	70800	87822	04910	22056	45
46	0670584	0687112	0703736	0720450	0737249	0754129	0771083	0788107	0805195	0822343	46
47	70859	87389	04014	20730	37530	54411	71366	88391	05480	22629	47
48	71133	87665	04292	21009	37811	54693	71649	88675	05766	22915	48
49	0671408	0687941	0704570	0721288	0738091	0754975	0771932	0788959	0806051	0823202	49
50	71683	88218	04848	21568	38372	55257	72216	89244	06336	23488	50
51	71958	88494	05126	21847	38653	55539	72499	89528	06622	23774	51
52	0672232	0688771	0705040	0722126	0738934	0755821	0772782	0789813	0806907	0824060	52
53	72507	89047	05682	22406	39215	56103	73065	90097	07193	24347	53
54	72782	89324	05960	22685	39495	56385	73349	90381	07478	24633	54
55	0673057	0689600	0706238	0722965	0739776	0756667	0773632	0790666	0807763	0824920	55
56	73332	89877	06516	23244	40057	56949	73915	90950	08049	25206	56
57	73607	90153	06794	23524	40338	57231	74199	91235	08334	25492	57
58	0673882	0690430	0707072	0723803	0740619	0757514	0774482	0791519	0808620	0825779	58
59	74157	90706	07350	24083	40900	57796	74765	91804	08305	26065	59
60	74432	90983	07628	24363	41181	58078	75049	92088	09191	26352	60

Parts for Seconds.

(v.)

	70°		71°		72°		73°		74°		75°		76°		77°		78°		79°		80°		
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	"
1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1
2	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	10	10	10	10	2
3	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	3
4	18	18	18	18	18	18	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	4
5	23	23	23	23	23	23	23	23	23	23	23	23	24	24	24	24	24	24	24	24	24	24	5
6	27	27	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	29	29	29	29	29	6
7	32	32	32	32	32	32	32	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	7
8	36	37	37	37	37	37	37	37	37	37	37	38	38	38	38	38	38	38	38	38	38	38	8
9	41	41	41	41	41	42	42	42	42	42	42	42	42	42	43	43	43	43	43	43	43	43	9
10	46	46	46	46	46	46	46	46	47	47	47	47	47	47	47	47	47	48	48	48	48	48	10
11	50	50	50	51	51	51	51	51	51	51	52	52	52	52	52	52	52	52	52	52	52	53	11
12	55	55	55	55	55	55	56	56	56	56	56	56	56	57	57	57	57	57	57	57	57	57	12
13	59	59	60	60	60	60	60	60	61	61	61	61	61	61	61	62	62	62	62	62	62	62	13
14	64	64	64	64	65	65	65	65	65	65	66	66	66	66	66	66	66	67	67	67	67	67	14
15	68	69	69	69	69	69	70	70	70	70	70	70	71	71	71	71	71	71	71	71	71	72	15
16	73	73	73	74	74	74	74	74	75	75	75	75	75	75	76	76	76	76	76	76	76	76	16
17	77	78	78	78	78	79	79	79	79	79	80	80	80	80	80	80	81	81	81	81	81	81	17
18	82	82	83	83	83	83	83	84	84	84	84	85	85	85	85	85	85	86	86	86	86	86	18
19	87	87	87	87	88	88	88	88	89	89	89	89	89	89	90	90	90	90	90	90	91	91	19
20	91	91	92	92	92	92	93	93	93	93	94	94	94	94	94	95	95	95	95	95	95	95	20
21	96	96	96	97	97	97	97	98	98	98	98	99	99	99	99	99	100	100	100	100	100	100	21
22	100	101	101	101	101	102	102	102	103	103	103	103	103	104	104	104	104	105	105	105	105	105	22
23	105	105	105	106	106	106	107	107	107	107	108	108	108	108	109	109	109	109	109	109	110	110	23
24	109	110	110	110	111	111	111	112	112	112	112	113	113	113	113	114	114	114	114	114	115	115	24
25	114	114	115	115	115	116	116	116	117	117	117	117	118	118	118	118	119	119	119	119	119	119	25
26	118	119	119	120	120	120	121	121	121	121	122	122	122	123	123	123	123	124	124	124	124	124	26
27	123	123	124	124	124	125	125	125	126	126	126	127	127	127	128	128	128	128	128	128	129	129	27
28	128	128	128	129	129	129	130	130	131	131	131	131	132	132	132	133	133	133	133	133	133	134	28
29	132	133	133	133	134	134	134	135	135	135	136	136	136	137	137	137	138	138	138	138	138	138	29
30	137	137	138	138	138	139	139	139	140	140	140	141	141	141	142	142	142	143	143	143	143	143	30
31	141	142	142	143	143	143	144	144	144	145	145	145	146	146	146	147	147	147	148	148	148	148	31
32	146	146	147	147	148	148	148	149	149	149	150	150	151	151	151	152	152	152	152	152	152	153	32
33	150	151	151	152	152	153	153	153	154	154	154	155	155	156	156	156	156	157	157	157	157	158	33
34	155	155	156	156	157	157	158	158	158	159	159	160	160	160	161	161	161	162	162	162	162	162	34
35	159	160	160	161	161	162	162	163	163	164	164	164	165	165	166	166	166	166	167	167	167	167	35
36	164	165	165	166	166	166	167	167	168	168	169	169	169	170	170	170	171	171	171	172	172	172	36
37	169	169	170	170	171	171	172	172	172	173	173	174	174	174	175	175	175	176	176	176	176	177	37
38	173	174	174	175	175	176	176	177	177	178	178	178	179	179	180	180	181	181	181	181	181	181	38
39	178	178	179	179	180	180	181	181	182	182	183	183	183	184	184	185	185	185	186	186	186	186	39
40	182	183	183	184	184	185	185	186	186	187	187	188	188	189	189	189	190	190	190	191	191	191	40
41	187	187	188	188	189	189	190	191	191	192	192	192	193	193	194	194	194	195	195	195	196	196	41
42	191	192	193	193	194	194	195	195	196	196	197	197	198	198	198	199	199	200	200	200	201	201	42
43	196	197	197	198	198	199	199	200	200	201	201	202	202	203	203	204	204	204	205	205	205	205	43
44	200	201	202	202	203	203	204	205	205	206	206	207	207	207	208	208	209	209	209	210	210	210	44
45	205	206	206	207	207	208	209	209	210	210	211	211	212	212	213	213	213	214	214	214	215	215	45
46	210	210	211	211	212	213	213	214	214	215	215	216	216	217	217	218	218	219	219	219	220	220	46
47	214	215	215	216	217	217	218	218	219	220	220	221	221	222	222	222	223	223	224	224	224	224	47
48	219	219	220	221	221	222	223	223	224	224	225	225	226	226	227	227	228	228	228	229	229	229	48
49	223	224	225	225	226	227	228	228	229	229	230	231	231	231	232	232	233	233	233	234	234	234	49
50	228	229	229	230	231	231	232	232	233	234	234	235	235	236	236	237	237	238	238	238	239	239	50
51	232	233	234	234	235	236	236	237	238	238	239	239	240	240	241	241	242	242	243	243	243	243	51
52	237	238	238	239	240	240	241	242	242	243	243	244	245	245	246	246	247	247	247	248	248	248	52
53	241	242	243	244	244	245	246	246	247	248	248	249	249	250	250	251	251	252	252	253	253	253	53
54	246	247	248	248	249	250	250	251	252	252	253	253	254	255	255	256	256	257	257	257	258	258	54
55	251	251	252	253	254	254	255	256	256	257	258	258	259	259	260	260	261	261	262	262	263	263	55
56	255	256	257	257	258	259	260	260	261	262	262	263	263	264	265	265	266	266	267	267	267	267	56
57	260	261	261	262	263	264	264	265	266	266	267	268	268	269	270	270	270	271	271	272	272	272	57
58	264	265	266	267	267	268	269	270	270	271	272	272	273	273	274	275	275	276	276	276	277	277	58
59	269	270	270	271	272	273	274	274	275	276	276	277	277	278	279	279	280	280	281	281	282	282	59
60	273	274	275	276	277	277	278	279	280	280	281	282	282	283	283	284	284	285	286	286	286	286	60

(v.)

Nat. Versines.

	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	
0	0826352	0843565	0860827	0878131	0895471	0912844	0930243	0947664	0965100	0982548	0
1	0826638	0843853	0861115	0878419	0895761	0913134	0930534	0947954	0965391	0982838	1
2	26925	44140	61403	78708	96050	13424	30824	48245	65682	83129	2
3	27211	44427	61691	78997	96339	13714	31114	48535	65973	83420	3
4	0827498	0844715	0861979	0879286	0896629	0914003	0931404	0948826	0966263	0983711	4
5	27784	45002	62267	79574	96918	14293	31694	49116	66554	84002	5
6	28071	45290	62555	79863	97207	14583	31985	49407	66845	84293	6
7	0828357	0845577	0862844	0880152	0897497	0914873	0932275	0949698	0967136	0984583	7
8	28644	45864	63132	80441	97786	15163	32565	49988	67426	84874	8
9	28931	46152	63420	80730	98075	15453	32855	50279	67717	85165	9
10	0829217	0846439	0863708	0881018	0898365	0915742	0933146	0950569	0968008	0985456	10
11	29504	46727	63996	81307	98654	16032	33436	50860	68298	85747	11
12	29790	47014	64284	81596	98944	16322	33726	51150	68589	86038	12
13	0830077	0847302	0864573	0881885	0899233	0916612	0934016	0951441	0968880	0986329	13
14	30364	47589	64861	82174	99522	16902	34307	51731	69171	86619	14
15	30650	47877	65149	82463	99812	17192	34597	52022	69461	86910	15
16	0830937	0848164	0865437	0882751	0900101	0917432	0934837	0952312	0969752	0987201	16
17	31224	48452	65726	83040	00391	17772	35177	52603	70043	87492	17
18	31511	48739	66014	83329	00680	18061	35468	52893	70334	87783	18
19	0831797	0849027	0866302	0883618	0900970	0918351	0935758	0953184	0970624	0988074	19
20	32084	49314	66590	83907	01259	18641	36048	53475	70915	88365	20
21	32371	49602	66879	84196	01549	18931	36339	53765	71206	88656	21
22	0832658	0849889	0867167	0884485	0901838	0919221	0936629	0954056	0971497	0988946	22
23	32944	50177	67455	84774	02128	19511	36919	54346	71788	89237	23
24	33231	50465	67744	85063	02417	19801	37209	54637	72078	89528	24
25	0833518	0850752	0868032	0885352	0902707	0920091	0937500	0954928	0972369	0989819	25
26	33805	51040	68320	85641	02996	20381	37790	55218	72660	90110	26
27	34092	51328	68609	85930	03286	20671	38080	55509	72951	90401	27
28	0834379	0851615	0868897	0886219	0903575	0920961	0938371	0955799	0973241	0990692	28
29	34665	51903	69185	86508	03865	21251	38661	56090	73532	90983	29
30	34952	52191	69474	86797	04154	21541	38951	56381	73823	91273	30
31	0835239	0852478	0869762	0887086	0904444	0921831	0939242	0956671	0974114	0991564	31
32	35526	52766	70051	87375	04733	22121	39532	56962	74405	91855	32
33	35813	53054	70339	87664	05023	22411	39822	57252	74695	92146	33
34	0836100	0853341	0870627	0887953	0905312	0922701	0940113	0957543	0974986	0992437	34
35	36387	53629	70916	88242	05602	22991	40403	57834	75277	92728	35
36	36674	53917	71204	88531	05892	23281	40694	58124	75568	93019	36
37	0836961	0854205	0871493	0888820	0906181	0923571	0940984	0958415	0975859	0993310	37
38	37248	54492	71781	89109	06471	23861	41274	58706	76149	93600	38
39	37535	54780	72070	89398	06760	24151	41565	58996	76440	93891	39
40	0837822	0855068	0872358	0889687	0907050	0924441	0941855	0959287	0976731	0994182	40
41	38109	55356	72647	89977	07340	24731	42146	59578	77022	94473	41
42	38396	55644	72935	90266	07629	25021	42436	59868	77313	94764	42
43	0838683	0855932	0873224	0890555	0907919	0925311	0942726	0960159	0977603	0995055	43
44	38970	56219	73512	90844	08209	25601	43017	60449	77894	95346	44
45	39257	56507	73801	91133	08498	25891	43307	60740	78185	95637	45
46	0839544	0856795	0874090	0891422	0908788	0926182	0943598	0961031	0978476	0995998	46
47	39832	57083	74378	91711	09078	26472	43888	61321	78767	96218	47
48	40119	57371	74667	92001	09367	26762	44178	61612	79058	96509	48
49	0840406	0857659	0874955	0892290	0909657	0927052	0944469	0961903	0979348	0996800	49
50	40693	57947	75244	92579	09947	27342	44759	62193	79639	97091	50
51	40980	58235	75533	92868	10236	27632	45050	62484	79930	97382	51
52	0841267	0858523	0875821	0893157	0910526	0927922	0945340	0962775	0980221	0997673	52
53	41555	58811	76110	93447	10816	28212	45631	63066	80512	97964	53
54	41842	59099	76398	93736	11106	28503	45921	63356	80803	98255	54
55	0842129	0859387	0876687	0894025	0911395	0928793	0946212	0963647	0981093	0998546	55
56	42416	59675	76976	94314	11685	29083	46502	63938	81384	98836	56
57	42704	59963	77264	94604	11975	29373	46793	64228	81675	99127	57
58	0842991	0860251	0877553	0894893	0912265	0929663	0947083	0964519	0981966	0999418	58
59	43278	60539	77842	95182	12554	29953	47374	64810	82257	99709	59
60	43565	60827	78131	95471	12844	30243	47664	65100	82548	1000000	60

Parts for Seconds.

(v.)

	80°		81°		82°		83°		84°		85°		86°		87°		88°		89°		90°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
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3	14	14	14	14	14	14	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	3
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9	43	43	43	43	43	43	43	43	43	43	43	43	44	44	44	44	44	44	44	44	44	9
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54	258	258	259	259	259	260	260	260	260	261	261	261	261	261	262	262	262	262	262	262	262	54
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58	277	277	278	278	278	279	279	279	280	280	280	280	281	281	281	281	281	281	281	281	281	58
59	282	282	283	283	283	284	284	284	284	285	285	285	285	286	286	286	286	286	286	286	286	59
60	286	287	287	288	288	288	289	289	289	290	290	290	290	290	290	290	291	291	291	291	291	60

Nat. Versines.

(v.)

	90°	91°	92°	93°	94°	95°	96°	97°	98°	99°	
0	1000000	1017452	1034900	1052336	1069757	1087156	1104529	1121869	1139173	1156435	0
1	1000291	1017743	1035190	1052626	1070047	1087446	1104818	1122158	1139461	1156722	1
2	00582	18034	35481	52917	70337	87735	05107	22447	39749	57009	2
3	00873	18325	35772	53207	70627	88025	05396	22736	40037	57296	3
4	1001164	1018616	1036062	1053498	1070917	1088315	1105686	1123024	1140325	1157584	4
5	01454	18907	36353	53788	71207	88605	05975	23313	40613	57871	5
6	01745	19197	36644	54079	71497	88894	06264	23602	40901	58158	6
7	1002036	1019488	1036934	1054369	1071788	1089184	1106553	1123890	1141189	1158445	7
8	02327	19779	37225	54660	72078	89474	06843	24179	41477	58733	8
9	02618	20070	37516	54950	72368	89764	07132	24467	41765	59020	9
10	1002909	1020361	1037807	1055241	1072658	1090053	1107421	1124756	1142053	1159307	10
11	03200	20652	38097	55531	72948	90343	07710	25045	42341	59594	11
12	03401	20942	38388	55822	73238	90633	07999	25333	42629	59881	12
13	1003781	1021233	1038679	1056112	1073528	1090922	1108289	1125622	1142917	1160168	13
14	04072	21524	38969	56402	73818	91212	08578	25910	43205	60456	14
15	04363	21815	39260	56693	74109	91502	08867	26199	43493	60743	15
16	1004654	1022106	1039551	1056983	1074399	1091791	1109156	1126488	1143781	1161030	16
17	04945	22397	39841	57274	74689	92081	09449	26776	44068	61317	17
18	05236	22687	40132	57564	74979	92371	09734	27065	44356	61604	18
19	1005527	1022978	1040422	1057854	1075269	1092660	1110023	1127353	1144644	1161891	19
20	05818	23269	40713	58145	75559	92950	10313	27642	44932	62178	20
21	06109	23560	41004	58435	75849	93240	10602	27930	45220	62465	21
22	1006400	1023851	1041294	1058726	1076139	1093529	1110891	1128219	1145508	1162752	22
23	06690	24141	41585	59016	76429	93819	11180	28507	45795	63039	23
24	06981	24432	41876	59306	76719	94108	11469	28796	46083	63326	24
25	1007272	1024723	1042166	1059597	1077009	1094398	1111758	1129084	1146371	1163613	25
26	07563	25014	42457	59887	77299	94688	12047	29373	46659	63900	26
27	07854	25305	42748	60178	77589	94977	12336	29661	46946	64187	27
28	1008145	1025595	1043038	1060468	1077879	1095267	1112625	1129949	1147234	1164474	28
29	08436	25886	43329	60758	78169	95556	12914	30238	47522	64761	29
30	08727	26177	43619	61049	78459	95846	13203	30526	47809	65048	30
31	1009017	1026468	1043910	1061339	1078749	1096135	1113492	1130815	1148097	1165335	31
32	09308	26759	44201	61629	79039	96425	13781	31103	48385	65621	32
33	09599	27049	44491	61920	79329	96714	14070	31391	48672	65908	33
34	1009890	1027340	1044782	1062210	1079619	1097004	1114359	1131680	1148960	1166195	34
35	10181	27631	45072	62500	79909	97293	14648	31968	49248	66482	35
36	10472	27922	45363	62791	80199	97583	14937	32256	49535	66769	36
37	1010763	1028212	1045654	1063081	1080489	1097872	1115226	1132545	1149823	1167056	37
38	11054	28503	45944	63371	80779	98162	15515	32833	50111	67342	38
39	11344	28794	46235	63661	81069	98451	15804	33121	50398	67629	39
40	1011635	1029085	1046525	1063952	1081359	1098741	1116093	1133410	1150686	1167916	40
41	11926	29376	46816	64242	81649	99030	16382	33698	50973	68203	41
42	12217	29666	47107	64532	81939	99320	16671	33986	51261	68489	42
43	1012508	1029957	1047397	1064823	1082228	1099609	1116960	1134274	1151548	1168776	43
44	12799	30248	47688	65113	82518	99899	17249	34563	51836	69063	44
45	13090	30539	47978	65403	82808	1100188	17537	34851	52123	69350	45
46	1013381	1030829	1048269	1065693	1083098	1100478	1117826	1135139	1152411	1169636	46
47	13671	31120	48559	65984	83388	100767	18115	35427	52698	69923	47
48	13962	31411	48850	66274	83678	101056	18404	35716	52986	70210	48
49	1014253	1031702	1049140	1066564	1083968	1101346	1118693	1136004	1153273	1170496	49
50	14544	31992	49431	66854	84258	101635	18982	36292	53561	70783	50
51	14835	32283	49721	67145	84547	101925	19270	36580	53848	71069	51
52	1015126	1032574	1050012	1067435	1084837	1102214	1119559	1136868	1154136	1171356	52
53	15417	32864	50302	67725	85127	102503	19848	37156	54423	71643	53
54	15707	33155	50593	68015	85417	102793	20137	37445	54710	71929	54
55	1015998	1033446	1050884	1068306	1085707	1103082	1120436	1137733	1154998	1172216	55
56	16289	33737	51174	68596	85997	103371	20714	38021	55285	72502	56
57	16580	34027	51465	68886	86286	103661	21003	38309	55573	72789	57
58	1016871	1034318	1051755	1069176	1086576	1103900	1121292	1138597	1155860	1173075	58
59	17162	34609	52046	69466	86866	104239	21581	38835	56147	73362	59
60	17452	34900	52336	69757	87156	104529	21869	39173	56435	73648	60

Parts for Seconds.

(v.)

	90°		91°		92°		93°		94°		95°		96°		97°		98°		99°		100°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
1	5	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1
2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	2
3	15	15	15	15	15	15	15	15	15	14	14	14	14	14	14	14	14	14	14	14	14	3
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7	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	33	33	33	7
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14	68	68	68	68	68	68	68	68	68	68	68	68	68	67	67	67	67	67	67	67	67	14
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42	204	204	204	204	203	203	203	203	203	203	203	203	203	202	202	202	202	201	201	201	201	42
43	208	208	208	208	208	208	208	208	208	208	208	207	207	207	207	206	206	206	206	205	205	43
44	213	213	213	213	213	213	213	213	213	213	212	212	212	212	212	211	211	211	210	210	210	44
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46	223	223	223	223	223	223	223	222	222	222	222	222	222	222	221	221	221	221	220	220	220	46
47	228	228	228	228	228	228	227	227	227	227	227	227	227	226	226	226	226	225	225	225	224	47
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49	238	238	237	237	237	237	237	237	237	237	237	236	236	236	235	235	235	235	234	234	234	49
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53	257	257	257	257	257	257	257	256	256	256	256	256	255	255	255	255	254	254	254	253	253	53
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55	267	267	267	267	266	266	266	266	266	266	266	265	265	265	265	264	264	264	263	263	263	55
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59	286	286	286	286	286	286	286	286	285	285	285	285	284	284	284	284	283	283	283	282	282	59
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(v.)

Nat. Versines,

	100°	101°	102°	103°	104°	105°	106°	107°	108°	109°	
0	1173648	1190609	1207912	1224951	1241922	1258819	1275637	1292372	1309017	1325568	0
1	1173935	1191095	1208196	1225235	1242204	1259100	1275917	1292650	1309294	1325843	1
2	74221	91380	08481	25518	42486	59381	76197	92928	09570	26118	2
3	74508	91666	08765	25801	42769	59662	76476	93206	09847	26393	3
4	1174794	1191951	1209050	1226085	1243051	1259943	1276756	1293484	1310123	1326668	4
5	75080	92237	09334	26368	43333	60224	77035	93762	10400	26943	5
6	75367	92622	09619	26651	43615	60505	77315	94040	10676	27218	6
7	1175653	1192807	1209903	1226935	1243897	1260785	1277594	1294318	1310953	1327493	7
8	75940	93093	10187	27218	44179	61066	77874	94596	11229	27768	8
9	76226	93378	10472	27501	44461	61347	78153	94874	11506	28042	9
10	1176512	1193664	1210756	1227784	1244743	1261628	1278432	1295152	1311782	1328317	10
11	76798	93949	11041	28068	45025	61909	78712	95430	12059	28592	11
12	77085	94234	11325	28351	45307	62189	78991	95708	12335	28867	12
13	1177371	1194520	1211609	1228634	1245589	1262470	1279270	1295986	1312611	1329141	13
14	77657	94805	11893	28917	45871	62751	79550	96264	12888	29416	14
15	77944	95090	12178	29200	46153	63031	79829	96542	13164	29691	15
16	1178230	1195376	1212462	1229484	1246435	1263312	1280108	1296819	1313440	1329965	16
17	78516	95661	12746	29767	46717	63593	80388	97097	13716	30240	17
18	78802	95946	13030	30050	46999	63873	80667	97375	13993	30514	18
19	1179088	1196231	1213315	1230333	1247281	1264154	1280946	1297653	1314269	1330789	19
20	79375	96517	13599	30616	47563	64434	81225	97930	14545	31063	20
21	79661	96802	13883	30899	47845	64715	81504	98208	14821	31338	21
22	1179947	1197087	1214167	1231182	1248126	1264995	1281783	1298486	1315097	1331612	22
23	80233	97372	14451	31465	48408	65276	82062	98763	15373	31887	23
24	80519	97657	14735	31748	48690	65556	82342	99041	15649	32161	24
25	1180805	1197943	1215019	1232031	1248972	1265837	1282621	1299318	1315925	1332436	25
26	81091	98228	15304	32314	49253	66117	82900	99596	16201	32710	26
27	81377	98513	15588	32597	49535	66397	83179	99873	16477	32984	27
28	1181664	1198798	1215872	1232880	1249817	1266678	1283458	1300151	1316753	1333258	28
29	81950	99083	16156	33163	50098	66958	83736	00428	17029	33583	29
30	82236	99368	16440	33445	50380	67238	84015	00706	17305	33807	30
31	1182522	1199653	1216724	1233728	1250662	1267519	1284294	1300983	1317581	1334081	31
32	82608	99938	17008	34011	50943	67799	84573	01261	17856	34355	32
33	83094	1200223	17292	34294	51225	68079	84852	01538	18132	34629	33
34	1183380	1200508	1217575	1234577	1251506	1268359	1285131	1301815	1318408	1334903	34
35	83665	00793	17859	34859	51788	68640	85410	02093	18684	35178	35
36	83951	01078	18143	35142	52069	68920	85688	02370	18959	35452	36
37	1184237	1201363	1218427	1235425	1252351	1269200	1285967	1302647	1319235	1335726	37
38	84523	01648	18711	35708	52632	69480	86246	02924	19511	36000	38
39	84809	01933	18995	35990	52914	69760	86525	03202	19786	36274	39
40	1185095	1202218	1219279	1236273	1253195	1270040	1286803	1303479	1320062	1336548	40
41	85381	02502	19562	36556	53477	70320	87082	03756	20337	36821	41
42	85667	02787	19846	36838	53758	70600	87361	04033	20613	37095	42
43	1185952	1203072	1220130	1237121	1254039	1270881	1287639	1304310	1320889	1337369	43
44	86238	03357	20414	37403	54321	71161	87918	04587	21164	37643	44
45	86524	03642	20697	37686	54602	71440	88196	04864	21440	37917	45
46	1186810	1203927	1220981	1237968	1254883	1271720	1288475	1305141	1321715	1338191	46
47	87096	04211	21265	38251	55165	72000	88753	05418	21990	38464	47
48	87381	04496	21549	38534	55446	72280	89032	05695	22266	38738	48
49	1187667	1204781	1221832	1238816	1255727	1272560	1289310	1305972	1322541	1339012	49
50	87953	05066	22116	39098	56008	72840	89589	06249	22816	39285	50
51	88239	05350	22399	39381	56289	73120	89867	06526	23092	39559	51
52	1188524	1205635	1222683	1239663	1256571	1273400	1290146	1306803	1323367	1339833	52
53	88810	05920	22967	39946	56852	73679	90424	07080	23642	40106	53
54	89095	06204	23250	40228	57133	73959	90702	07357	23917	40380	54
55	1189381	1206489	1223534	1240510	1257414	1274239	1290981	1307633	1324193	1340653	55
56	89667	06773	23817	40793	57695	74519	91259	07910	24468	40927	56
57	89952	07058	24101	41075	57976	74798	91537	08187	24743	41200	57
58	1190238	1207343	1224384	1241357	1258257	1275076	1291815	1308464	1325018	1341473	58
59	90523	07627	24668	41640	58538	75358	92094	08740	25293	41747	59
60	90809	07912	24951	41922	58819	75637	92372	09017	25568	42020	60

Parts for Seconds.

(v.)

	100°		101°		102°		103°		104°		105°		106°		107°		108°		109°		110°		
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	"
1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1
2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	2
3	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	3
4	19	19	19	19	19	19	19	19	19	19	19	19	19	19	18	18	18	18	18	18	18	18	4
5	24	24	24	24	24	24	24	24	24	23	23	23	23	23	23	23	23	23	23	23	23	23	5
6	29	29	29	29	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	27	27	6
7	33	33	33	33	33	33	33	33	33	33	33	33	33	32	32	32	32	32	32	32	32	32	7
8	38	38	38	38	38	38	38	38	38	38	37	37	37	37	37	37	37	37	37	37	36	36	8
9	43	43	43	43	43	43	43	42	42	42	42	42	42	42	42	41	41	41	41	41	41	41	9
10	48	48	48	48	47	47	47	47	47	47	47	47	46	46	46	46	46	46	46	46	46	46	10
11	53	52	52	52	52	52	52	52	52	52	52	51	51	51	51	51	51	50	50	50	50	50	11
12	57	57	57	57	57	57	57	56	56	56	56	56	56	56	55	55	55	55	55	55	55	55	12
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18	86	86	86	86	85	85	85	85	85	84	84	84	84	83	83	83	83	83	82	82	82	82	18
19	91	91	90	90	90	90	90	89	89	89	89	89	88	88	88	88	87	87	87	87	87	87	19
20	95	95	95	95	95	95	94	94	94	94	93	93	93	93	92	92	92	92	91	91	91	91	20
21	100	100	100	100	100	99	99	99	99	98	98	98	98	97	97	97	97	96	96	96	96	96	21
22	105	105	105	105	104	104	104	104	103	103	103	103	102	102	102	101	101	101	101	100	100	100	22
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25	119	119	119	119	118	118	118	118	117	117	117	117	116	116	116	115	115	115	114	114	114	114	25
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27	129	129	128	128	128	128	127	127	127	126	126	126	125	125	125	124	124	124	123	123	123	123	27
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32	153	152	152	152	152	151	151	151	150	150	150	150	149	148	148	148	147	147	146	146	146	146	32
33	158	157	157	156	156	156	155	155	155	154	154	154	153	153	153	152	152	151	151	150	150	150	33
34	162	162	162	161	161	161	160	160	160	159	159	158	158	158	157	157	156	156	155	155	155	155	34
35	167	167	167	166	166	166	165	165	165	164	164	164	163	163	162	162	161	161	160	160	159	159	35
36	172	172	171	171	171	170	170	169	169	169	168	168	167	167	166	166	166	165	165	164	164	164	36
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46	220	219	219	219	218	218	217	217	216	216	215	215	214	214	213	213	212	211	211	210	210	210	46
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59	282	281	281	280	280	279	279	278	277	277	276	276	275	274	274	273	272	271	270	270	269	269	59
60	286	286	286	285	284	284	283	283	282	282	281	280	280	279	278	277	277	276	275	274	273	273	60

(v.)

Nat. Versines.

	110°	111°	112°	113°	114°	115°	116°	117°	118°	119°	
0	1342020	1358368	1374607	1390731	1406737	1422618	1438371	1453991	1469472	1484810	0
1	1342294	1358640	1374876	1390999	1407002	1422882	1438633	1454250	1469728	1485064	1
2	42567	58911	75146	91267	07268	23146	38394	54509	69085	85318	2
3	42840	59183	75416	91534	07534	23409	39155	54768	70242	85573	3
4	1343113	1359454	1375685	1391802	1407799	1423673	1439417	1455027	1470499	1485827	4
5	43387	59725	75955	92070	08065	23936	39678	55286	70755	86081	5
6	43660	59997	76224	92337	08331	24199	39939	55545	71012	86335	6
7	1343933	1360268	1376494	1392605	1408596	1424463	1440200	1455804	1471269	1486590	7
8	44206	60540	76763	92872	08862	24726	40462	56063	71525	86844	8
9	44479	60811	77033	93140	09127	24990	40723	56322	71782	87098	9
10	1344752	1361082	1377302	1393407	1409392	1425253	1440984	1456580	1472038	1487352	10
11	45025	61353	77571	93675	09658	25516	41245	56839	72294	87606	11
12	45298	61625	77841	93942	09923	25779	41506	57098	72551	87860	12
13	1345571	1361896	1378110	1394209	1410188	1426043	1441767	1457357	1472807	1488114	13
14	45844	62167	78379	94477	10454	26306	42028	57615	73063	88367	14
15	46117	62438	78649	94744	10719	26569	42289	57874	73320	88621	15
16	1346390	1362709	1378918	1395011	1410984	1426832	1442550	1458133	1473576	1488875	16
17	46663	62980	79187	95278	11249	27095	42810	58391	73832	89129	17
18	46936	63251	79456	95546	11514	27358	43071	58650	74088	89383	18
19	1347209	1363522	1379725	1395813	1411780	1427621	1443332	1458908	1474344	1489636	19
20	47481	63793	79994	96080	12045	27884	43593	59167	74600	89890	20
21	47754	64064	80263	96347	12310	28147	43853	59425	74856	90143	21
22	1348027	1364335	1380532	1396614	1412575	1428410	1444114	1459633	1475112	1490397	22
23	48299	64606	80801	96881	12840	28672	44375	59942	75368	90650	23
24	48572	64877	81070	97148	13104	28935	44635	60200	75624	90904	24
25	1348845	1365148	1381339	1397415	1413369	1429198	1444896	1460458	1475880	1491157	25
26	49117	65418	81608	97682	13634	29461	45156	60716	76136	91411	26
27	49390	65689	81877	97949	13899	29723	45417	60974	76392	91664	27
28	1349662	1365960	1382146	1398216	1414164	1429986	1445677	1461233	1476647	1491917	28
29	49935	66231	82415	98482	14429	30249	45938	61491	76903	92170	29
30	50207	66501	82683	98749	14693	30511	46198	61749	77159	92424	30
31	1350480	1366772	1382952	1399016	1414958	1430774	1446458	1462007	1477414	1492677	31
32	50752	67043	83221	99283	15223	31036	46718	62265	77670	92930	32
33	51025	67313	83490	99549	15487	31299	46979	62523	77926	93183	33
34	1351297	1367584	1383758	1399816	1415752	1431561	1447239	1462780	1478181	1493436	34
35	51569	67854	84027	100083	16016	31823	47499	63038	78436	93689	35
36	51842	68125	84295	100349	16281	32086	47759	63296	78692	93942	36
37	1352114	1368395	1384564	1400616	1416545	1432348	1448019	1463554	1478947	1494195	37
38	52386	68665	84832	100382	16810	32610	49279	63812	79203	94448	38
39	52658	68936	85101	101149	17074	32873	48539	64069	79458	94701	39
40	1352931	1369206	1385369	1401415	1417339	1433135	1448799	1464327	1479713	1494953	40
41	53203	69477	85638	101681	17603	33397	49059	64585	79968	95206	41
42	53475	69747	85906	101948	17867	33659	49319	64842	80224	95459	42
43	1353747	1370017	1386174	1402214	1418131	1433921	1449579	1465100	1480479	1495711	43
44	54019	70287	86443	102480	18396	34183	49839	65357	80734	95964	44
45	54291	70557	86711	102747	18660	34445	50098	65615	80989	96217	45
46	1354563	1370828	1386979	1403013	1418924	1434707	1450358	1465872	1481244	1496469	46
47	54835	71098	87247	103279	19188	34969	50618	66129	81499	96722	47
48	55107	71368	87516	103545	19452	35231	50878	66387	81754	96974	48
49	1355379	1371638	1387784	1403811	1419716	1435493	1451137	1466644	1482009	1497226	49
50	55651	71908	88052	104078	19980	35755	51397	66901	82263	97479	50
51	55923	72178	88320	104344	20244	36017	51656	67158	82518	97731	51
52	1356194	1372448	1388588	1404610	1420508	1436278	1451916	1467416	1482773	1497983	52
53	56466	72718	88856	104876	20772	36540	52175	67673	83028	98236	53
54	56738	72988	89124	105142	21036	36802	52435	67930	83282	98488	54
55	1357010	1373258	1389392	1405408	1421300	1437063	1452694	1468187	1483537	1498740	55
56	57281	73528	89660	105673	21563	37325	52954	68444	83792	98992	56
57	57553	73797	89928	105939	21827	37587	53213	68701	84046	99244	57
58	1357825	1374067	1390196	1406205	1422091	1437848	1453472	1468958	1484301	1499496	58
59	58096	74337	90463	106471	22355	38110	53731	69215	84555	99748	59
60	58368	74607	90731	106737	22618	38371	53991	69472	84810	100000	60

Parts for Seconds.

(v.)

	110°		111°		112°		113°		114°		115°		116°		117°		118°		119°		120°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
1	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1
2	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	8	8	2
3	14	14	14	14	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	3
4	18	18	18	18	18	18	18	18	18	18	18	17	17	17	17	17	17	17	17	17	17	4
5	23	23	23	23	22	22	22	22	22	22	22	22	22	22	21	21	21	21	21	21	21	5
6	27	27	27	27	27	27	27	27	27	26	26	26	26	26	26	26	26	26	25	25	25	6
7	32	32	32	32	31	31	31	31	31	31	31	31	30	30	30	30	30	30	30	30	29	7
8	36	36	36	36	36	36	36	36	35	35	35	35	35	35	34	34	34	34	34	34	34	8
9	41	41	41	41	40	40	40	40	40	40	39	39	39	39	39	39	38	38	38	38	38	9
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11	50	50	50	50	49	49	49	49	49	49	48	48	48	48	47	47	47	47	46	46	46	11
12	55	54	54	54	54	54	53	53	53	53	53	52	52	52	52	51	51	51	51	51	50	12
13	59	59	59	59	58	58	58	58	58	57	57	57	56	56	56	56	55	55	55	55	55	13
14	64	64	63	63	63	63	62	62	62	62	61	61	61	60	60	60	60	59	59	59	59	14
15	68	68	68	68	67	67	67	67	66	66	66	65	65	65	64	64	64	64	63	63	63	15
16	73	73	72	72	72	72	71	71	71	71	70	70	69	69	69	68	68	68	68	67	67	16
17	77	77	77	77	76	76	76	76	75	75	75	74	74	74	73	73	73	72	72	72	71	17
18	82	82	81	81	81	81	80	80	80	79	79	79	78	78	78	77	77	77	76	76	76	18
19	87	86	86	86	85	85	85	84	84	84	83	83	82	82	82	81	81	81	80	80	80	19
20	91	91	91	90	90	90	89	89	89	88	88	88	87	87	86	86	85	85	84	84	84	20
21	96	95	95	95	94	94	94	93	93	93	92	92	92	91	91	90	90	89	89	89	88	21
22	100	100	100	99	99	99	98	98	97	97	96	96	95	95	95	94	94	93	93	92	92	22
23	105	104	104	104	103	103	103	102	102	101	101	101	100	100	99	99	98	98	97	97	97	23
24	109	109	109	108	108	107	107	107	106	106	105	105	104	104	103	103	102	102	101	101	101	24
25	114	114	113	113	112	112	111	111	110	110	109	109	108	108	107	107	107	106	105	105	105	25
26	118	118	118	117	117	116	116	116	115	115	114	114	113	113	112	112	111	111	110	110	109	26
27	123	123	122	122	121	121	121	120	120	119	119	118	118	117	117	116	116	115	114	114	113	27
28	128	127	127	126	126	125	125	124	124	123	123	122	121	121	120	120	119	119	118	118	118	28
29	132	132	131	131	130	130	130	129	128	128	127	127	126	126	125	125	124	124	123	122	122	29
30	137	136	136	135	135	134	134	133	133	132	132	131	131	130	130	129	128	128	127	127	126	30
31	141	141	140	140	139	139	138	138	137	137	136	136	135	134	134	133	133	132	131	131	130	31
32	146	145	145	144	144	143	143	142	142	141	141	140	139	139	138	138	137	136	136	135	134	32
33	150	150	149	149	148	148	147	147	146	146	145	144	144	143	143	142	141	141	140	139	139	33
34	155	154	154	153	153	152	152	151	151	150	149	149	148	148	147	146	146	145	144	143	143	34
35	159	159	158	158	157	157	156	156	155	154	154	153	153	152	151	150	150	150	148	148	147	35
36	164	163	163	162	162	161	161	160	159	159	158	158	157	156	156	155	154	153	153	152	151	36
37	169	168	167	167	166	166	165	164	164	163	163	162	161	161	160	159	158	158	157	156	155	37
38	173	173	172	171	171	170	170	169	168	168	167	166	166	165	164	163	163	162	161	160	160	38
39	178	177	177	176	175	175	174	173	173	172	171	171	170	169	168	168	167	166	165	165	164	39
40	182	182	181	180	179	179	179	178	177	176	176	175	174	174	173	172	171	170	170	169	168	40
41	187	186	186	185	184	184	183	182	182	181	180	179	179	178	177	176	176	175	174	173	172	41
42	191	191	190	189	189	188	187	186	186	185	185	184	183	182	181	181	180	179	178	177	176	42
43	196	195	195	194	193	193	192	191	190	190	189	188	187	187	186	185	184	183	182	181	181	43
44	200	200	199	198	198	197	197	196	195	194	193	193	192	191	190	189	188	187	187	186	185	44
45	205	204	204	203	202	201	201	200	199	199	198	197	196	195	194	193	193	192	191	190	189	45
46	210	209	208	207	207	206	205	205	204	203	202	201	200	200	199	198	197	196	195	194	193	46
47	214	213	213	212	211	211	210	209	208	207	207	206	205	204	203	202	201	200	199	198	197	47
48	219	218	217	217	216	215	214	213	213	212	211	210	209	208	207	206	205	205	204	203	202	48
49	223	222	222	221	220	220	219	218	217	216	215	214	214	213	212	211	210	209	208	207	206	49
50	228	227	226	226	225	224	223	222	221	221	220	219	218	217	216	215	214	213	212	211	210	50
51	232	232	231	230	229	228	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	51
52	237	236	235	235	234	233	232	231	230	229	228	228	227	226	225	224	223	221	220	219	218	52
53	241	241	240	239	238	237	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	53
54	246	245	244	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	54
55	251	250	249	248	247	246	245	245	244	243	242	241	240	239	238	236	235	234	233	232	231	55
56	255	254	253	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	237	236	235	56
57	260	259	258	257	256	255	254	253	252	251	250	249	249	247	246	245	244	243	242	240	239	57
58	264	263	262	262	261	260	259	258	257	256	255	254	253	252	251	249	248	247	246	245	244	58
59	269	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	251	250	249	248	59
60	273	272	272	271	270	269	268	267	266	265	264	263	261	260	259	258	257	256	254	253	252	60

(v.)

Nat. Versines.

	120°	121°	122°	123°	124°	125°	126°	127°	128°	129°	
0	1500000	1515038	1529919	1544639	1559193	1573576	1587785	1601815	1615662	1629320	0
1	1500252	1515287	1530166	1544883	1559434	1573815	1588021	1602047	1615891	1629546	1
2	00504	15537	30413	45127	59675	74053	88256	02280	16120	29772	2
3	00756	15786	30659	45371	59916	74291	88491	02512	16349	29998	3
4	1501007	1516035	1530906	1545615	1560157	1574529	1588726	1602744	1616578	1630224	4
5	01259	16284	31152	45858	60398	74767	88961	02976	16807	30450	5
6	01511	16533	31399	46102	60639	75005	89196	03208	17036	30676	6
7	1501762	1516782	1531645	1546346	1560880	1575243	1589431	1603440	1617265	1630902	7
8	02014	17031	31891	46589	61121	75481	89666	03672	17494	31127	8
9	02266	17280	32138	46833	61361	75719	89901	03904	17722	31353	9
10	1502517	1517529	1532384	1547076	1561602	1575957	1590136	1604136	1617951	1631578	10
11	02769	17778	32630	47320	61843	76195	90371	04367	18180	31804	11
12	03020	18027	32876	47563	62083	76432	90606	04599	18408	32029	12
13	1503271	1518276	1533122	1547807	1562324	1576670	1590840	1604831	1618637	1632255	13
14	03523	18525	33369	48050	62565	76908	91075	05062	18865	32480	14
15	03774	18773	33615	48293	62805	77145	91310	05294	19094	32705	15
16	1504025	1519022	1533861	1548537	1563045	1577383	1591544	1605526	1619322	1632931	16
17	04277	19271	34107	48780	63286	77620	91779	05757	19551	33156	17
18	04528	19519	34352	49023	63526	77858	92013	05988	19779	33381	18
19	1504779	1519768	1534598	1549266	1563766	1578095	1592248	1606220	1620007	1633606	19
20	05030	20016	34844	49509	64007	78332	92482	06451	20236	33831	20
21	05281	20265	35090	49752	64247	78570	92716	06682	20464	34056	21
22	1505532	1520513	1535336	1549995	1564487	1578807	1592951	1606914	1620692	1634281	22
23	05783	20761	35581	50238	64727	79044	93185	07145	20920	34506	23
24	06034	21010	35827	50481	64967	79281	93419	07376	21148	34731	24
25	1506285	1521258	1536072	1550724	1565207	1579518	1593653	1607607	1621376	1634955	25
26	06536	21506	36318	50966	65447	79755	93887	07838	21604	35180	26
27	06786	21754	36563	51209	65687	79992	94121	08069	21831	35405	27
28	1507037	1522002	1536809	1551452	1565927	1580229	1594355	1608300	1622059	1635629	28
29	07288	22251	37054	51694	66167	80466	94589	08531	22287	35854	29
30	07538	22499	37300	51937	66406	80703	94823	08761	22515	36078	30
31	1507789	1522747	1537545	1552180	1566646	1580940	1595057	1608992	1622742	1636303	31
32	08040	22995	37790	52422	66886	81177	95290	09223	22970	36527	32
33	08290	23242	38035	52665	67125	81413	95524	09454	23197	36751	33
34	1508541	1523490	1538281	1552907	1567365	1581650	1595758	1609684	1623425	1636976	34
35	08791	23738	38526	53149	67604	81886	95991	09915	23652	37200	35
36	09041	23986	38771	53392	67844	82123	96225	10145	23880	37424	36
37	1509292	1524234	1539016	1553634	1568083	1582360	1596458	1610376	1624107	1637648	37
38	09542	24481	39261	53876	68323	82596	96692	10606	24334	37872	38
39	09792	24729	39506	54118	68562	82832	96925	10836	24561	38096	39
40	1510043	1524977	1539751	1554360	1568801	1583069	1597159	1611067	1624789	1638320	40
41	10293	25224	39996	54602	69040	83305	97392	11297	25016	38544	41
42	10543	25472	40240	54844	69280	83541	97625	11527	25243	38768	42
43	1510793	1525719	1540485	1555086	1569519	1583777	1597858	1611757	1625470	1638992	43
44	11043	25967	40730	55328	69758	84014	98092	11987	25697	39215	44
45	11293	26214	40975	55570	69997	84250	98325	12217	25924	39439	45
46	1511543	1526461	1541219	1555812	1570236	1584486	1598558	1612447	1626150	1639663	46
47	11793	26709	41464	56054	70475	84722	98791	12677	26377	39886	47
48	12043	26956	41708	56296	70714	84958	99024	12907	26604	40110	48
49	1512293	1527203	1541953	1556537	1570952	1585194	1599257	1613137	1626831	1640333	49
50	12543	27450	42197	56779	71191	85429	99489	13367	27057	40557	50
51	12792	27697	42442	57021	71430	85665	99722	13596	27284	40780	51
52	1513042	1527944	1542686	1557262	1571669	1585901	1599955	1613826	1627510	1641003	52
53	13292	28191	42930	57504	71907	86137	100885	14744	28416	41896	53
54	13541	28438	43174	57745	72146	86372	100420	14285	27963	41450	54
55	1513791	1528685	1543419	1557987	1572384	1586608	1600653	1614515	1628189	1641673	55
56	14040	28932	43663	58228	72623	86844	100885	14744	28416	41896	56
57	14290	29179	43907	58469	72861	87079	101118	14974	28642	42119	57
58	1514539	1529426	1544151	1558711	1573100	1587315	1601350	1615203	1628868	1642342	58
59	14789	29673	44395	58952	73338	87550	101583	15432	29091	42565	59
60	15038	29919	44639	59193	73576	87785	101815	15662	29320	42788	60

Parts for Seconds.

(v.)

	120°		121°		122°		123°		124°		125°		126°		127°		128°		129°		130°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'
1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1
2	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7	2
3	13	13	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	3
4	17	17	17	17	16	16	16	16	16	16	16	16	16	16	15	15	15	15	15	15	15	4
5	21	21	21	21	21	20	20	20	20	20	20	20	20	19	19	19	19	19	19	19	19	5
6	25	25	25	25	25	25	24	24	24	24	24	24	24	23	23	23	23	23	23	22	22	6
7	29	29	29	29	29	29	28	28	28	28	28	28	27	27	27	27	27	27	26	26	26	7
8	34	33	33	33	33	33	32	32	32	32	32	32	31	31	31	31	31	30	30	30	8	
9	38	38	37	37	37	37	37	36	36	36	36	36	35	35	35	35	34	34	34	34	33	9
10	42	42	42	41	41	41	41	40	40	40	40	39	39	39	39	38	38	38	38	37	37	10
11	46	46	46	45	45	45	45	44	44	44	44	43	43	43	43	42	42	42	41	41	41	11
12	50	50	50	50	49	49	49	49	48	48	48	47	47	47	46	46	46	46	45	45	45	12
13	55	54	54	54	53	53	53	53	52	52	52	51	51	51	50	50	50	49	49	49	48	13
14	59	58	58	58	58	57	57	57	56	56	56	55	55	55	54	54	53	53	52	52	52	14
15	63	63	62	62	62	61	61	61	60	60	60	59	59	58	58	58	57	57	57	56	56	15
16	67	67	66	66	66	65	65	65	64	64	64	63	63	62	62	62	61	61	60	60	59	16
17	71	71	71	70	70	70	69	69	68	68	68	67	67	66	66	65	65	64	64	64	63	17
18	76	75	75	74	74	74	73	73	72	72	71	71	71	70	70	69	69	68	68	67	67	18
19	80	79	79	79	78	78	77	77	76	76	75	75	75	74	74	73	73	72	72	71	71	19
20	84	84	83	83	82	82	81	81	80	80	79	79	78	78	77	77	76	76	75	75	74	20
21	88	88	87	87	86	86	85	85	84	84	83	83	82	82	81	81	80	80	79	79	78	21
22	92	92	91	91	90	90	89	89	88	88	87	87	86	86	85	85	84	83	83	82	82	22
23	97	96	96	95	95	94	94	93	92	92	91	91	90	90	89	88	88	87	87	86	85	23
24	101	100	100	99	99	98	98	97	96	96	95	95	94	94	93	92	92	91	90	89	89	24
25	105	104	104	103	103	102	102	101	100	100	99	99	98	97	97	96	96	95	94	94	93	25
26	109	109	108	107	107	106	106	105	104	104	103	103	102	101	101	100	99	99	98	97	97	26
27	113	113	112	112	111	110	110	109	109	108	107	107	106	105	105	104	103	102	102	101	100	27
28	118	117	116	116	115	114	114	113	113	112	111	111	110	109	108	108	107	106	105	105	104	28
29	122	121	121	120	119	119	118	117	117	116	115	114	114	113	112	112	111	110	109	108	108	29
30	126	125	125	124	123	123	122	121	121	120	119	118	118	117	116	115	115	114	113	112	111	30
31	130	130	129	128	127	127	126	125	125	124	123	122	122	121	120	119	118	118	117	116	115	31
32	134	134	133	132	132	131	130	129	129	128	127	126	126	125	124	123	122	121	120	120	119	32
33	139	138	137	136	136	135	134	133	133	132	131	130	129	129	128	127	126	125	124	123	123	33
34	143	142	141	141	140	139	138	137	137	136	135	134	133	133	132	131	130	129	128	127	126	34
35	147	146	145	145	144	143	142	141	141	140	139	138	137	136	136	135	134	133	132	131	130	35
36	151	150	150	149	148	147	146	146	145	144	143	142	141	140	139	138	138	137	136	135	134	36
37	155	155	154	153	152	151	150	150	149	148	147	146	145	144	143	142	141	140	139	139	137	37
38	160	159	158	157	156	155	154	154	153	152	151	150	149	148	147	146	145	144	143	142	141	38
39	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	145	39
40	168	167	166	165	164	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	40
41	172	171	170	169	169	168	167	166	165	164	163	162	161	160	159	158	157	156	154	153	152	41
42	176	175	175	174	173	172	171	170	169	168	167	166	165	164	163	162	160	159	158	157	156	42
43	181	180	179	178	177	176	175	174	173	172	171	170	169	168	166	165	164	163	162	161	160	43
44	185	184	183	182	181	180	179	178	177	176	175	174	173	171	170	169	168	167	166	165	163	44
45	189	188	187	186	185	184	183	182	181	180	179	178	177	175	174	173	172	171	170	168	167	45
46	193	192	191	191	189	188	187	186	185	184	183	182	180	179	178	177	176	175	173	172	171	46
47	197	196	195	194	193	192	191	190	189	188	187	185	184	183	182	181	180	178	177	176	175	47
48	202	201	199	198	197	196	195	194	193	192	191	190	188	187	186	185	183	182	181	180	178	48
49	206	205	204	203	201	200	199	198	197	196	195	193	192	191	190	188	187	186	185	183	182	49
50	210	209	208	207	206	204	203	202	201	200	199	197	196	195	194	192	191	190	188	187	186	50
51	214	213	212	211	210	209	207	206	205	204	203	201	200	199	197	196	195	194	192	191	189	51
52	218	217	216	215	214	213	211	210	209	208	207	205	204	203	201	200	199	197	196	195	193	52
53	223	221	220	219	218	217	215	214	213	212	210	209	208	207	205	204	203	201	200	198	197	53
54	227	226	224	223	222	221	220	218	217	216	214	213	212	210	209	208	206	205	203	202	201	54
55	231	230	229	227	226	225	224	222	221	220	218	217	216	214	213	212	210	209	207	206	204	55
56	235	234	233	232	230	229	228	226	225	224	222	221	220	218	217	215	214	212	211	209	208	56
57	239	238	237	236	234	233	232	230	229	228	226	225	224	222	221	219	218	216	215	213	212	57
58	244	242	241	240	238	237	236	234	233	232	230	229	228	226	225	223	222	220	219	217	215	58
59	248	246	246	244	243	241	240	239	237	236	234	233	231	230	228	227	225	224	222	221	219	59
60	252	251	249	248	247	245	244	243	241	240	238	237	235	234	232	231	229	228	226	224	223	60

(v.)

Nat. Versines.

	130°	131°	132°	133°	134°	135°	136°	137°	138°	139°	
0	1642788	1656059	1669131	1681998	1694658	1707107	1719340	1731354	1743145	1754710	0
1	1643010	1656279	1669347	1682211	1694868	1707312	1719542	1731552	1743339	1754900	1
2	43233	56498	69563	82424	95077	07518	19744	31750	43534	55091	2
3	43456	56717	69779	82636	95286	07724	19946	31949	43729	55282	3
4	1643679	1656937	1669995	1682849	1695495	1707929	1720148	1732147	1743923	1755472	4
5	43901	57156	70211	83061	95704	08135	20349	32345	44117	55663	5
6	44124	57375	70427	83274	95913	08340	20551	32543	44312	55854	6
7	1644346	1657594	1670642	1683486	1696122	1708545	1720753	1732741	1744506	1756044	7
8	44569	57814	70858	83698	96331	08750	20954	32939	44700	56234	8
9	44791	58033	71074	83911	96539	08956	21156	33137	44894	56425	9
10	1645013	1658252	1671290	1684123	1696748	1709161	1721357	1733335	1745088	1756615	10
11	45236	58471	71505	84335	96957	09366	21559	33532	45282	56805	11
12	45458	58690	71721	84547	97165	09571	21760	33730	45476	56995	12
13	1645680	1658908	1671936	1684759	1697374	1709776	1721962	1733928	1745670	1757185	13
14	45902	59127	72152	84971	97582	09981	22163	34125	45864	57375	14
15	46124	59346	72367	85183	97791	10185	22364	34323	46057	57565	15
16	1646346	1659565	1672582	1685395	1697999	1710390	1722565	1734520	1746251	1757755	16
17	46568	59783	72797	85607	98207	10595	22766	34717	46445	57945	17
18	46790	60002	73013	85818	98415	10800	22967	34915	46638	58134	18
19	1647012	1660220	1673228	1686030	1698623	1711004	1723168	1735112	1746832	1758324	19
20	47233	60439	73443	86242	98832	11209	23369	35309	47025	58514	20
21	47455	60657	73658	86453	99040	11413	23570	35506	47218	58703	21
22	1647677	1660875	1673873	1686665	1699248	1711617	1723771	1735703	1747412	1758893	22
23	47898	61094	74088	86876	99456	11822	23971	35900	47605	59082	23
24	48120	61312	74302	87088	99663	12026	24172	36097	47798	59271	24
25	1648341	1661530	1674517	1687299	1699871	1712230	1724372	1736294	1747991	1759461	25
26	48563	61748	74732	87510	1700079	12434	24573	36491	48184	59650	26
27	48784	61966	74947	87721	00287	12639	24773	36688	48377	59839	27
28	1649006	1662184	1675161	1687933	1700494	1712843	1724974	1736884	1748570	1760028	28
29	49227	62402	75376	88144	00702	13047	25174	37081	48763	60217	29
30	49448	62620	75590	88355	00909	13250	25374	37277	48956	60406	30
31	1649669	1662838	1675805	1688566	1701117	1713454	1725575	1737474	1749148	1760595	31
32	49890	63056	76019	88977	01324	13658	25775	37670	49341	60784	32
33	50111	63273	76233	88987	01531	13862	25975	37867	49534	60972	33
34	1650332	1663491	1676448	1689198	1701739	1714066	1726175	1738063	1749726	1761161	34
35	50553	63709	76662	89409	01946	14269	26375	38259	49919	61350	35
36	50774	63926	76876	89620	02153	14473	26575	38455	50111	61538	36
37	1650995	1664144	1677020	1689830	1702360	1714676	1726775	1738652	1750303	1761727	37
38	51216	64361	77304	90041	02567	14880	26974	38848	50496	61915	38
39	51437	64579	77518	90251	02774	15083	27174	39044	50688	62104	39
40	1651657	1664796	1677732	1690462	1702981	1715286	1727374	1739239	1750880	1762292	40
41	51878	65013	77946	90672	03188	15490	27573	39435	51072	62480	41
42	52098	65230	78160	90882	03395	15693	27773	39631	51264	62668	42
43	1652319	1665448	1678373	1691093	1703601	1715896	1727972	1739827	1751456	1762856	43
44	52539	65665	78587	91303	03808	16099	28172	40023	51648	63045	44
45	52760	65882	78801	91513	04015	16302	28371	40218	51840	63233	45
46	1652980	1666099	1679014	1691723	1704221	1716505	1728570	1740414	1752032	1763420	46
47	53200	66316	79228	91933	04428	16708	28770	40609	52223	63608	47
48	53421	66533	79441	92143	04634	16911	28969	40805	52415	63796	48
49	1653641	1666749	1679655	1692353	1704841	1717113	1729168	1741000	1752607	1763984	49
50	53861	66966	79868	92563	05047	17316	29367	41195	52798	64171	50
51	54081	67183	80081	92773	05253	17519	29566	41391	52989	64359	51
52	1654301	1667399	1680295	1692983	1705459	1717721	1729765	1741586	1753181	1764547	52
53	54521	67616	80508	93192	05665	17924	29963	41781	53372	64734	53
54	54741	67833	80721	93402	05872	18126	30162	41976	53563	64921	54
55	1654961	1668049	1680934	1693611	1706078	1718329	1730361	1742171	1753755	1765109	55
56	55180	68266	81147	93821	06284	18531	30560	42366	53946	65296	56
57	55400	68482	81360	94030	06489	18733	30758	42561	54137	65483	57
58	1655620	1668698	1681573	1694240	1706695	1718936	1730957	1742755	1754328	1765670	58
59	55840	68914	81786	94449	06901	19138	31155	42950	54519	65857	59
60	56059	69131	81998	94658	07107	19340	31354	43145	54710	66044	60

Parts for Seconds.

(v.)

	130°		131°		132°		133°		134°		135°		136°		137°		138°		139°		140°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	"
1	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	1
2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	2
3	11	11	11	11	11	11	11	11	10	10	10	10	10	10	10	10	10	10	9	9	9	3
4	15	15	15	15	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	13	12	4
5	19	18	18	18	18	18	18	18	17	17	17	17	17	17	17	16	16	16	16	16	16	5
6	22	22	22	22	22	21	21	21	21	21	21	20	20	20	20	20	19	19	19	19	19	6
7	26	26	26	25	25	25	25	25	24	24	24	24	24	23	23	23	23	22	22	22	22	7
8	30	29	29	29	29	28	28	28	28	28	27	27	27	27	26	26	26	26	25	25	25	8
9	33	33	33	33	32	32	32	32	32	31	31	31	31	30	30	30	29	29	29	29	28	9
10	37	37	37	36	36	36	35	35	35	35	34	34	34	33	33	33	32	32	32	31	31	10
11	41	41	40	40	40	39	39	39	38	38	38	37	37	37	36	36	36	35	35	35	34	11
12	45	44	44	44	43	43	43	42	42	41	41	41	40	40	40	39	39	39	38	38	37	12
13	48	48	48	47	47	46	46	46	45	45	45	44	44	43	43	43	42	42	41	41	41	13
14	52	52	51	51	50	50	50	49	49	48	48	47	47	47	46	46	45	45	45	44	44	14
15	56	55	55	54	54	54	53	53	52	52	51	51	51	50	50	49	49	48	48	47	47	15
16	59	59	59	58	58	57	57	56	56	55	55	54	54	53	53	52	52	51	51	50	50	16
17	63	63	62	62	61	61	60	60	59	59	58	58	57	57	56	56	55	55	54	54	53	17
18	67	66	66	65	65	64	64	63	63	62	62	61	61	60	60	59	58	58	57	57	56	18
19	71	70	70	69	68	68	67	67	66	66	65	65	64	63	63	62	62	61	60	60	59	19
20	74	74	73	73	72	71	71	70	70	69	69	68	67	67	66	66	65	64	64	63	62	20
21	78	77	77	76	76	75	74	74	73	73	72	71	70	70	69	69	68	67	67	66	65	21
22	82	81	80	80	79	79	78	77	77	76	75	75	74	73	73	72	71	71	70	69	69	22
23	85	85	84	84	83	82	82	81	80	80	79	78	77	77	76	75	75	74	73	72	72	23
24	89	88	88	87	86	86	85	84	84	83	82	81	80	79	79	78	77	76	76	75	75	24
25	93	92	91	91	90	89	89	88	87	86	86	85	84	83	83	82	81	80	80	79	78	25
26	97	96	95	94	94	93	92	91	91	90	89	88	87	87	86	85	84	84	83	82	81	26
27	100	100	99	98	97	97	96	95	94	93	92	92	91	90	89	88	88	87	86	85	84	27
28	104	103	102	102	101	100	99	98	98	97	96	96	94	93	93	92	91	90	89	88	87	28
29	108	107	106	105	104	104	103	102	101	100	99	99	98	97	96	95	94	93	92	91	90	29
30	111	111	110	109	108	107	106	105	105	104	103	102	101	100	99	98	97	96	95	94	93	30
31	115	114	113	113	112	111	110	109	108	107	106	105	104	103	103	102	101	100	99	98	97	31
32	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	32
33	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	33
34	126	125	124	123	123	121	121	120	119	118	117	116	114	113	112	111	110	109	108	107	106	34
35	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	112	111	110	109	35
36	134	133	132	131	130	129	128	127	126	124	123	122	121	120	119	118	117	116	115	113	112	36
37	137	136	135	134	133	132	131	130	129	128	127	126	125	123	122	121	120	119	118	117	115	37
38	141	140	139	138	137	136	135	134	133	131	130	129	128	127	126	124	123	122	121	120	118	38
39	145	144	143	142	141	139	138	137	136	135	134	132	131	130	129	128	126	125	124	123	122	39
40	149	147	146	145	144	143	142	141	139	138	137	136	135	133	132	131	130	128	127	126	125	40
41	152	151	150	149	148	147	145	144	143	142	141	139	138	137	136	134	133	132	130	129	128	41
42	156	155	154	152	151	150	149	148	146	145	144	143	141	140	139	138	136	135	134	132	131	42
43	160	159	157	156	155	154	152	151	150	149	147	146	145	144	142	141	139	138	137	135	134	43
44	163	162	161	160	159	157	156	155	153	152	151	150	148	147	145	144	143	141	140	139	137	44
45	167	166	165	163	162	161	160	158	157	156	154	153	152	150	149	147	146	145	143	142	140	45
46	171	170	168	167	166	164	163	162	160	159	158	156	155	154	152	151	149	148	146	145	143	46
47	175	173	172	171	169	168	167	165	164	163	161	160	158	157	155	154	152	151	150	148	146	47
48	178	177	176	174	173	172	170	169	167	166	165	163	162	160	159	157	156	154	153	151	150	48
49	182	181	179	178	177	175	174	172	171	169	168	167	165	164	162	160	159	157	156	154	153	49
50	186	184	183	182	180	179	177	176	174	173	171	170	168	167	165	164	162	161	160	157	156	50
51	189	188	187	185	184	182	181	179	178	176	175	173	172	170	169	167	165	164	162	161	159	51
52	193	192	190	189	187	186	184	183	181	180	178	177	175	174	172	170	169	167	165	164	162	52
53	197	195	194	192	191	189	188	186	185	183	182	180	178	177	175	174	172	170	169	167	165	53
54	201	199	198	196	195	193	191	190	188	187	185	184	182	180	179	177	175	173	172	170	168	54
55	204	203	201	200	198	197	195	193	192	190	189	187	185	184	182	180	178	177	175	173	171	55
56	208	206	205	203	202	200	199	197	195	194	192	190	189	187	185	183	182	180	178	176	174	56
57	212	210	209	207	205	204	202	200	199	197	195	194	192	190	188	187	185	183	181	180	178	57
58	215	214	212	211	209	207	206	204	202	200	199	197	195	194	192	190	188	186	184	183	181	58
59	219	218	216	214	213	211	209	207	206	204	202	201	199	197	195	193	191	190	188	186	184	59
60	223	221	219	219	216	214	213	211	209	207	206	204	202	200	198	196	195	193	190	189	187	60

(v.)

Nat. Versines.

	140°	141°	142°	143°	144°	145°	146°	147°	148°	149°	
0	1766044	1777146	1788011	1798636	1809017	1819152	1829038	1838671	1848048	1857167	0
1	1766231	1777329	1788190	1798211	1809188	1819319	1829200	1838829	1848202	1857317	1
2	66418	77512	88369	98985	99359	19486	29363	38987	48356	57467	2
3	66605	77695	88548	99160	99530	19652	29525	39146	48510	57616	3
4	1766792	1777878	1788727	1799335	1809700	1819819	1829688	1839304	1848664	1857766	4
5	66979	78060	88905	99510	99871	19985	29850	39462	48818	57916	5
6	67165	78243	89084	99685	10042	20152	30012	39620	48972	58065	6
7	1767352	1778426	1789263	1799859	1810212	1820318	1830175	1839778	1849125	1858214	7
8	67538	78608	89441	1800034	10383	20485	30337	39936	49279	58364	8
9	67725	78791	89620	00208	10553	20651	30499	40094	49433	58513	9
10	1767911	1778973	1789798	1800383	1810723	1820817	1830661	1840251	1849586	1858662	10
11	68097	79156	89977	00557	10894	20983	30823	40409	49739	58811	11
12	68284	79338	90155	00731	11064	21149	30985	40567	49893	58960	12
13	1768470	1779520	1790333	1800906	1811234	1821315	1831146	1840724	1850046	1859109	13
14	68656	79702	90512	01080	11404	21481	31308	40882	50199	59253	14
15	68842	79885	90690	01254	11574	21647	31470	41039	50352	59466	15
16	1769028	1780067	1790868	1801428	1811744	1821813	1831631	1841196	1850505	1859555	16
17	69214	80249	91046	01602	11914	21978	31793	41354	50658	59704	17
18	69400	80430	91224	01776	12084	22144	31954	41511	50811	59852	18
19	1769585	1780612	1791401	1801950	1812253	1822310	1832116	1841668	1850964	1860001	19
20	69771	80794	91579	02123	12423	22475	32277	41825	51117	60149	20
21	69957	80976	91757	02297	12593	22641	32438	41982	51269	60298	21
22	1770142	1781157	1791935	1802471	1812762	1822806	1832599	1842139	1851422	1860446	22
23	70328	81339	92112	02644	12931	22971	32760	42296	51575	60594	23
24	70513	81521	92290	02818	13101	23136	32921	42452	51727	60742	24
25	1770699	1781702	1792467	1802991	1813270	1823302	1833082	1842609	1851879	1860890	25
26	70884	81883	92645	03164	13439	23467	33243	42766	52032	61038	26
27	71069	82065	92822	03338	13608	23632	33404	42922	52184	61186	27
28	1771254	1782246	1792999	1803511	1813778	1823797	1833565	1843079	1852336	1861334	28
29	71440	82427	93176	03684	13947	23961	33725	43235	52488	61482	29
30	71625	82608	93353	03857	14116	24126	33886	43391	52648	61629	30
31	1771810	1782789	1793530	1804030	1814284	1824291	1834046	1843548	1852792	1861777	31
32	71995	82970	93707	04203	14453	24456	34207	43704	52944	61924	32
33	72179	83151	93884	04376	14622	24620	34367	43860	53096	62072	33
34	1772364	1783332	1794061	1804548	1814791	1824785	1834528	1844016	1853248	1862219	34
35	72549	83513	94238	04721	14959	24949	34688	44172	53399	62366	35
36	72734	83694	94415	04894	15128	25114	34848	44328	53551	62514	36
37	1772918	1783874	1794591	1805066	1815296	1825278	1835008	1844484	1853702	1862661	37
38	73103	84055	94768	05239	15465	25442	35168	44640	53854	62808	38
39	73287	84235	94944	05411	15633	25606	35328	44795	54005	62955	39
40	1773472	1784416	1795121	1805584	1815801	1825770	1835488	1844951	1854156	1863102	40
41	73656	84596	95297	05756	15970	25934	35648	45106	54308	63249	41
42	73840	84776	95474	05928	16138	26098	35807	45262	54459	63396	42
43	1774024	1784957	1795650	1806101	1816306	1826262	1835967	1845417	1854610	1863542	43
44	74209	85137	95826	06273	16474	26426	36127	45573	54761	63689	44
45	74393	85317	96002	06445	16642	26590	36286	45728	54912	63836	45
46	1774577	1785497	1796178	1806617	1816809	1826753	1836446	1845883	1855063	1863982	46
47	74761	85677	96354	06789	16977	26917	36605	46038	55214	64128	47
48	74945	85857	96530	06960	17145	27081	36764	46193	55364	64275	48
49	1775128	1786037	1796706	1807132	1817313	1827244	1836924	1846348	1855515	1864421	49
50	75312	86217	96882	07304	17480	27407	37083	46503	55666	64567	50
51	75496	86396	97057	07475	17648	27571	37242	46658	55816	64713	51
52	1775679	1786576	1797233	1807647	1817815	1827734	1837401	1846813	1855966	1864860	52
53	75863	86756	97408	07819	17982	27897	37560	46967	56117	65006	53
54	76046	86935	97584	07990	18150	28060	37719	47122	56267	65151	54
55	1776230	1787115	1797759	1808161	1818317	1828223	1837878	1847277	1856417	1865297	55
56	76413	87294	97935	08333	18484	28386	38036	47431	56567	65443	56
57	76597	87473	98110	08504	18651	28549	38195	47585	56718	65589	57
58	1776780	1787652	1798285	1808675	1818818	1828712	1838354	1847740	1856868	1865734	58
59	76963	87832	98460	08846	18935	28875	38512	47894	57017	65880	59
60	77146	88011	98636	09017	19152	29038	38671	48048	57167	66025	60

Parts for Seconds

(v.)

	140°			141°			142°			143°			144°			145°			146°			147°			148°			149°			150°		
"	0'	30'		0'	30'		0'	30'		0'	30'		0'	30'		0'	30'		0'	30'		0'	30'		0'	30'		0'	30'		0'	"	
1	3	3		3	3		3	3		3	3		3	3		3	3		3	3		3	3		3	3		2	2		2	1	
2	6	6		6	6		6	6		6	6		6	6		6	5		5	5		5	5		5	5		5	5		5	2	
3	9	9		9	9		9	9		9	9		9	8		8	8		8	8		8	8		8	8		7	7		7	3	
4	12	12		12	12		12	12		12	11		11	11		11	11		11	11		10	10		10	10		10	10		10	4	
5	16	15		15	15		15	15		15	14		14	14		14	14		13	13		13	13		13	13		12	12		12	5	
6	19	19		18	18		18	18		18	17		17	17		17	16		16	16		16	16		15	15		15	15		15	6	
7	22	22		21	21		21	21		20	20		20	20		19	19		19	19		18	18		18	18		17	17		17	7	
8	25	25		24	24		24	24		23	23		23	23		22	22		22	21		21	21		21	20		20	20		19	8	
9	28	28		27	27		27	27		26	26		26	25		25	25		24	24		24	23		23	23		22	22		22	9	
10	31	31		30	30		30	29		29	28		28	28		27	27		27	26		26	26		26	25		25	25		24	10	
11	34	34		33	33		32	32		32	31		31	31		31	30		30	29		29	29		28	28		27	27		27	11	
12	37	37		37	36		36	35		35	34		34	33		33	33		32	32		32	31		31	30		30	30		29	12	
13	41	40		40	39		39	38		38	37		37	37		36	36		35	34		34	34		33	33		32	32		32	13	
14	44	43		43	42		42	41		41	40		40	39		39	38		38	37		37	36		36	35		35	34		34	14	
15	47	46		46	45		45	44		44	43		43	42		42	41		41	40		40	39		39	38		37	37		36	15	
16	50	49		48	48		47	46		46	45		44	44		44	44		43	42		42	41		41	40		39	39		39	16	
17	53	52		52	51		51	50		50	49		48	48		47	46		45	45		44	44		43	43		42	42		41	17	
18	56	56		55	54		54	53		53	52		51	51		50	49		49	48		48	47		46	46		45	44		44	18	
19	59	59		58	57		57	56		55	55		54	53		53	52		52	51		50	49		49	48		47	47		46	19	
20	62	62		61	60		60	59		58	58		57	56		56	55		54	53		52	51		51	50		49	49		48	20	
21	65	65		64	63		63	62		61	60		60	59		58	57		56	55		55	54		54	53		52	52		51	21	
22	69	68		67	66		66	65		64	63		63	62		61	60		60	59		58	57		57	56		55	54		53	22	
23	72	71		70	69		69	68		67	66		66	65		64	63		63	62		61	60		59	58		57	57		56	23	
24	75	74		73	72		72	71		70	69		68	68		67	66		65	64		63	63		62	61		60	59		58	24	
25	78	77		76	75		75	74		73	72		71	70		70	69		68	67		66	65		64	63		62	62		61	25	
26	81	80		79	78		78	77		76	75		74	73		72	71		71	70		69	68		67	66		65	64		63	26	
27	84	83		82	81		81	80		79	78		77	76		75	74		73	72		71	70		69	68		67	66		65	27	
28	87	86		85	84		84	83		82	81		80	79		78	77		76	75		74	73		72	71		70	69		68	28	
29	90	89		88	87		87	86		85	84		83	82		81	80		79	78		77	76		75	73		72	71		70	29	
30	93	93		92	91		90	89		88	87		85	84		83	82		82	80		79	78		77	76		75	74		73	30	
31	97	96		95	94		93	91		90	89		88	87		86	85		84	83		82	81		80	79		77	76		75	31	
32	100	99		98	97		96	94		93	92		91	90		89	88		87	86		85	83		82	81		80	79		78	32	
33	103	102		101	100		98	97		96	95		94	93		92	91		90	88		87	86		85	84		82	81		80	33	
34	106	105		104	103		101	100		99	98		97	96		95	93		92	91		90	89		87	86		85	84		82	34	
35	109	108		107	106		104	103		102	101		100	99		97	96		95	94		92	91		90	89		87	86		85	35	
36	112	111		110	109		107	106		105	104		103	101		100	99		98	96		95	94		92	91		90	89		87	36	
37	115	114		113	112		110	109		108	107		105	104		103	102		101	99		98	96		95	94		92	91		90	37	
38	118	117		116	115		113	112		111	110		108	107		106	104		103	102		100	99		98	96		95	94		92	38	
39	122	120		119	118		116	115		114	112		111	110		108	107		106	104		103	102		100	99		97	96		95	39	
40	125	123		122	121		119	118		117	115		114	113		111	110		109	107		106	104		103	101		100	98		97	40	
41	128	126		125	124		122	121		120	118		117	115		114	113		111	110		108	107		105	104		102	101		99	41	
42	131	130		128	127		125	124		123	121		120	118		117	115		114	112		111	109		108	106		105	103		102	42	
43	134	133		131	130		128	127		125	124		123	121		120	118		117	115		114	112		110	109		107	106		104	43	
44	137	136		134	133		131	130		128	127		125	124		122	121		120	118		116	115		113	111		110	108		107	44	
45	140	139		137	136		134	133		131	130		128	127		125	124		122	120		119	117		116	114		112	111		109	45	
46	143	142		140	139		137	136		134	133		131	130		128	126		125	123		121	120		118	117		115	113		112	46	
47	146	145		143	142		140	139		137	136		134	132		131	129		128	126		124	122		121	119		117	116		114	47	
48	150	148		146	145		143	142		140	138		137	135		133	132		131	128		127	125		123	122		120	118		116	48	
49	153	151		149	148		146	145		143	141		140	138		136	135		133	131		129	128		126	124		122	121		119	49	
50	156	154		152	151		149	148		146	144		142	141		139	137		136	134		132	130		128	127		125	123		121	50	
51	159	157		156	154		152	150		149	147		145	144		142	140		139	136		135	133		131	129		127	126		124	51	
52	162	160		159	157		155	153		152	150		148																				

(v.)

Nat. Versines.

	150°	151°	152°	153°	154°	155°	156°	157°	158°	159°	
0	1866025	1874620	1882948	1891007	1898794	1906308	1913546	1920505	1927184	1933580	0
1	1866171	1874761	1883084	1891139	1898922	1906431	1913664	1920619	1927293	1933685	1
2	66316	74902	83221	91271	99049	06554	13782	20732	27402	33789	2
3	66461	75043	83357	91402	99176	06676	13900	20846	27510	33893	3
4	1866607	1875183	1883493	1891534	1899304	1906799	1914018	1920959	1927619	1933997	4
5	66752	75324	83630	91666	99431	06922	14136	21072	27728	34101	5
6	66897	75465	83766	91798	99558	07044	14254	21185	27836	34205	6
7	1867042	1875605	1883902	1891929	1899685	1907167	1914372	1921299	1927945	1934308	7
8	67187	75746	84038	92061	99812	07289	14490	21412	28053	34412	8
9	67331	75886	84174	92192	99939	07411	14607	21525	28161	34515	9
10	1867476	1876026	1884310	1892323	1900065	1907533	1914725	1921638	1928270	1934619	10
11	67621	76167	84445	92455	00192	07655	14842	21750	28378	34722	11
12	67766	76307	84581	92586	00319	07778	14960	21863	28486	34826	12
13	1867910	1876447	1884717	1892717	1900445	1907900	1915077	1921976	1928594	1934929	13
14	68054	76587	84852	92848	00572	08021	15194	22088	28702	35032	14
15	68199	76727	84988	92979	00698	08143	15312	22201	28810	35135	15
16	1868343	1876867	1885123	1893110	1900825	1908265	1915429	1922313	1928917	1935238	16
17	68487	77006	85258	93241	00951	08387	15546	22426	29025	35341	17
18	68632	77146	85394	93371	01077	08508	15663	22538	29133	35444	18
19	1868776	1877286	1885529	1893502	1901203	1908630	1915780	1922650	1929240	1935547	19
20	68920	77425	85664	93633	01329	08751	15896	22762	29348	35650	20
21	69064	77565	85799	93763	01455	08873	16013	22875	29455	35752	21
22	1869207	1877704	1885934	1893894	1901581	1908994	1916130	1922987	1929562	1935855	22
23	69351	77844	86069	94024	01707	09115	16246	23098	29669	35957	23
24	69495	77983	86204	94154	01833	09236	16363	23210	29777	36060	24
25	1869639	1878122	1886338	1894284	1901958	1909357	1916479	1923322	1929884	1936162	25
26	69782	78261	86473	94415	02084	09478	16596	23434	29991	36264	26
27	69926	78400	86608	94545	02209	09599	16712	23545	30097	36366	27
28	1870069	1878539	1886742	1894675	1902335	1909720	1916828	1923657	1930204	1936468	28
29	70212	78678	86877	94805	02460	09841	16944	23768	30311	36570	29
30	70356	78817	87011	94934	02585	09961	17060	23880	30418	36672	30
31	1870499	1878956	1887145	1895064	1902711	1910082	1917176	1923991	1930524	1936774	31
32	70642	79095	87279	95194	02836	10202	17292	24102	30631	36876	32
33	70785	79233	87413	95323	02961	10323	17408	24213	30737	36977	33
34	1870928	1879372	1887548	1895453	1903086	1910443	1917523	1924324	1930843	1937079	34
35	71071	79510	87682	95582	03211	10563	17639	24435	30950	37181	35
36	71214	79649	87815	95712	03335	10684	17755	24546	31056	37282	36
37	1871357	1879787	1887949	1895841	1903460	1910804	1917870	1924657	1931162	1937383	37
38	71499	79925	88083	95970	03585	10924	17986	24768	31268	37465	38
39	71642	80063	88217	96099	03709	11044	18101	24878	31374	37586	39
40	1871784	1880201	1888350	1896229	1903834	1911164	1918216	1924989	1931480	1937687	40
41	71927	80339	88484	96358	03958	11284	18331	25099	31586	37788	41
42	72069	80477	88617	96486	04083	11403	18446	25210	31691	37889	42
43	1872212	1880615	1888751	1896615	1904207	1911523	1918561	1925320	1931797	1937990	43
44	72354	80753	88884	96744	04331	11643	18676	25430	31902	38091	44
45	72496	80891	89017	96873	04455	11762	18791	25541	32008	38191	45
46	1872638	1881028	1889150	1897001	1904579	1911882	1918906	1925651	1932113	1938292	46
47	72780	81166	89283	97130	04703	12001	19021	25761	32219	38393	47
48	72922	81304	89416	97258	04827	12120	19135	25871	32324	38493	48
49	1873064	1881441	1889549	1897387	1904951	1912239	1919250	1925981	1932429	1938593	49
50	73206	81578	89682	97515	05075	12358	19364	26090	32534	38694	50
51	73347	81716	89815	97643	05198	12478	19479	26200	32639	38794	51
52	1873489	1881853	1889948	1897771	1905322	1912597	1919593	1926310	1932744	1938894	52
53	73631	81990	90080	97900	05445	12715	19707	26419	32849	38994	53
54	73772	82127	90213	98028	05569	12834	19822	26529	32954	39094	54
55	1873914	1882264	1890345	1898156	1905692	1912953	1919936	1926638	1933058	1939194	55
56	74055	82401	90478	98283	05815	13072	20050	26747	33163	39294	56
57	74196	82538	90610	98411	05939	13190	20164	26857	33267	39394	57
58	1874338	1882674	1890742	1898539	1906062	1913309	1920277	1926966	1933372	1939494	58
59	74479	82811	90874	98667	06185	13427	20391	27075	33476	39593	59
60	74620	82948	91007	98794	06308	13546	20505	27184	33580	39693	60

Parts for Seconds.

(v.)

	150°		151°		152°		153°		154°		155°		156°		157°		158°		159°		160°		
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	"
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
2	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	2	
3	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	5	5	5	5	5	3	
4	10	10	9	9	9	9	9	9	8	8	8	8	8	8	8	7	7	7	7	7	7	4	
5	12	12	12	12	11	11	11	11	11	10	10	10	10	10	9	9	9	9	9	8	8	5	
6	15	14	14	14	14	13	13	13	13	13	12	12	12	12	11	11	11	11	10	10	10	6	
7	17	17	16	16	16	16	15	15	15	15	14	14	14	14	13	13	13	12	12	12	12	7	
8	19	19	19	19	18	18	18	17	17	17	16	16	16	16	15	15	15	14	14	14	13	8	
9	22	21	21	21	20	20	20	19	19	19	18	18	18	17	17	17	16	16	16	15	15	9	
10	24	24	24	23	23	22	22	22	21	21	20	20	20	19	19	19	18	18	17	17	17	10	
11	27	26	26	25	25	25	24	24	23	23	23	22	22	21	21	20	20	20	19	19	18	11	
12	29	29	28	28	27	27	26	26	25	25	25	24	24	23	23	22	22	21	21	20	20	12	
13	32	31	31	30	30	29	29	28	28	27	27	26	26	25	25	24	24	23	23	22	22	13	
14	34	33	33	32	32	31	31	30	30	29	29	28	28	27	27	26	25	25	24	24	23	14	
15	36	36	35	35	34	34	33	32	32	31	31	30	30	29	28	28	27	27	26	25	25	15	
16	39	38	38	37	36	36	35	35	34	33	33	32	32	31	30	30	29	28	28	27	27	16	
17	41	41	40	39	39	38	37	37	36	35	35	34	34	33	32	32	31	30	30	29	28	17	
18	44	43	42	42	41	40	40	39	38	38	37	36	35	35	34	33	33	32	31	31	30	18	
19	46	45	45	44	43	43	42	41	40	40	39	38	37	37	36	35	35	34	33	32	32	19	
20	48	48	47	46	46	45	44	43	42	42	41	40	39	39	38	37	36	36	35	34	33	20	
21	51	50	49	49	48	47	46	45	45	44	43	42	41	41	40	39	38	37	36	36	35	21	
22	53	53	52	51	50	49	48	48	47	46	45	44	43	43	42	41	40	39	38	37	36	22	
23	56	55	54	53	52	51	51	50	49	48	47	46	45	44	44	43	42	41	40	39	38	23	
24	58	57	56	56	55	54	53	52	51	50	49	48	47	46	45	45	44	43	42	41	40	24	
25	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	25	
26	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	26	
27	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	27	
28	68	67	66	65	64	63	62	61	59	58	57	56	55	54	53	52	51	50	49	48	46	28	
29	70	69	68	67	66	65	64	63	62	61	59	58	57	56	55	54	53	52	50	49	48	29	
30	73	72	71	69	68	67	66	65	64	63	61	60	59	58	57	56	55	53	52	51	50	30	
31	75	74	73	72	71	69	68	67	66	65	64	62	61	60	59	58	56	55	54	53	51	31	
32	78	76	75	74	73	72	70	69	68	67	66	64	63	62	61	59	58	57	56	54	53	32	
33	80	79	78	76	75	74	73	71	70	69	68	66	65	64	63	61	60	59	57	56	55	33	
34	82	81	80	79	77	76	75	74	72	71	70	68	67	66	64	63	62	60	59	58	56	34	
35	85	84	82	81	80	78	77	76	74	73	72	70	69	68	66	65	64	62	61	59	58	35	
36	87	86	85	83	82	81	79	78	76	75	74	72	71	70	68	67	65	64	63	61	60	36	
37	90	88	87	86	84	83	81	80	79	77	76	74	73	72	70	69	67	66	64	63	61	37	
38	92	91	89	88	86	85	84	82	81	79	78	76	75	73	72	70	69	68	66	65	63	38	
39	95	93	92	90	89	87	86	84	83	81	80	78	77	75	74	72	71	69	68	66	65	39	
40	97	95	94	93	91	90	88	87	85	83	82	80	79	77	76	74	73	71	70	68	66	40	
41	99	98	96	95	93	92	90	89	87	86	84	82	81	79	78	76	74	73	71	70	68	41	
42	102	100	99	97	96	94	92	91	89	88	86	84	83	81	80	78	76	75	73	71	70	42	
43	104	103	101	99	98	96	95	93	91	90	88	86	85	83	81	80	78	76	74	73	71	43	
44	107	105	103	102	100	98	97	95	93	92	90	88	87	85	83	82	80	78	76	75	73	44	
45	109	107	106	104	102	101	99	97	96	94	92	90	89	87	85	83	82	80	78	76	75	45	
46	112	110	108	106	105	103	101	100	98	96	94	92	91	89	87	85	84	82	80	78	76	46	
47	114	112	110	109	107	105	103	102	100	98	96	95	93	91	89	87	85	84	82	80	78	47	
48	116	115	113	111	109	107	106	104	102	100	98	97	95	93	91	89	87	85	83	81	80	48	
49	119	117	115	113	112	110	108	106	104	102	100	99	97	95	93	91	89	87	85	83	81	49	
50	121	119	118	116	114	112	110	108	106	104	102	101	99	97	95	93	91	89	87	85	83	50	
51	124	122	120	118	116	114	112	110	108	106	105	103	101	99	97	95	93	91	89	87	85	51	
52	126	124	122	120	118	116	114	112	110	109	107	105	103	101	98	96	94	92	90	88	86	52	
53	128	127	125	123	121	119	117	115	113	111	109	107	105	102	100	98	96	94	92	90	88	53	
54	131	129	127	125	123	121	119	117	115	113	111	109	106	104	102	100	98	96	94	92	90	54	
55	133	131	129	127	125	123	121	119	117	115	113	111	108	106	104	102	100	98	96	93	91	55	
56	136	134	132	130	127	125	123	121	119	117	115	113	110	108	106	104	102	99	97	95	93	56	
57	138	136	134	132	130	128	125	123	121	119	117	115	112	110	108	106	104	101	99	97	95	57	
58	141	138	136	134	132	130	128	125	123	121	119	117	114	112	110	108	105	103	101	98	96	58	
59	143	141	139	137	134	131	130	128	125	123	121	119	116	114	112	109	107	105	103	100	98	59	
60	145	143	141	139	136	134	132	130	127	125	123	121	118	116	114	111	109	107	104	102	99	60	

(v.)

Nat. Versines.

	160°	161°	162°	163°	164°	165°	166°	167°	168°	169°	
0	1939693	1945519	1951057	1956305	1961262	1965926	1970296	1974370	1978148	1981627	0
1	1939792	1945613	1951146	1956390	1961342	1966001	1970366	1974436	1978208	1981683	1
2	39891	45708	51236	56475	61422	66076	70436	74501	78268	81738	2
3	39991	45802	51326	56560	61502	66151	70507	74566	78329	81793	3
4	1940090	1945897	1951415	1956644	1961582	1966226	1970577	1974631	1978389	1981849	4
5	40189	45991	51505	56729	61662	66301	70647	74696	78449	81904	5
6	40288	46085	51594	56814	61741	66376	70717	74761	78509	81959	6
7	1940387	1946180	1951684	1956898	1961821	1966451	1970786	1974826	1978569	1982014	7
8	40486	46274	51773	56983	61901	66526	70856	74891	78629	82069	8
9	40585	46368	51862	57067	61980	66600	70926	74956	78689	82123	9
10	1940684	1946462	1951951	1957151	1962059	1966675	1970995	1975020	1978748	1982178	10
11	40782	46556	52040	57235	62139	66749	71065	75085	78808	82233	11
12	40881	46649	52129	57320	62218	66823	71134	75149	78867	82287	12
13	1940979	1946743	1952218	1957404	1962297	1966898	1971204	1975214	1978927	1982342	13
14	41078	46837	52307	57488	62376	66972	71273	75278	78986	82396	14
15	41176	46930	52396	57571	62455	67046	71342	75342	79046	82450	15
16	1941274	1947024	1952484	1957655	1962534	1967120	1971411	1975407	1979105	1982505	16
17	41372	47117	52573	57739	62613	67194	71480	75471	79164	82559	17
18	41471	47210	52662	57823	62692	67268	71549	75535	79223	82613	18
19	1941569	1947304	1952750	1957906	1962770	1967342	1971618	1975599	1979282	1982667	19
20	41667	47397	52838	57990	62849	67415	71687	75662	79341	82721	20
21	41764	47490	52926	58073	62928	67489	71755	75726	79399	82774	21
22	1941862	1947583	1953015	1958156	1963006	1967562	1971824	1975790	1979458	1982828	22
23	41960	47676	53103	58239	63084	67636	71893	75853	79517	82882	23
24	42058	47768	53191	58323	63163	67709	71961	75917	79575	82935	24
25	1942155	1947861	1953279	1958406	1963241	1967783	1972029	1975980	1979634	1982989	25
26	42253	47954	53366	58489	63319	67856	72098	76044	79692	83042	26
27	42350	48046	53454	58572	63397	67929	72166	76107	79750	83096	27
28	1942447	1948139	1953542	1958654	1963475	1968002	1972234	1976170	1979809	1983149	28
29	42544	48231	53629	58737	63553	68075	72302	76233	79867	83202	29
30	42642	48324	53717	58820	63631	68148	72370	76296	79925	83255	30
31	1942739	1948416	1953804	1958902	1963708	1968220	1972438	1976359	1979983	1983308	31
32	42836	48508	53892	58985	63786	68293	72506	76422	80041	83361	32
33	42932	48600	53979	59067	63863	68366	72573	76485	80098	83414	33
34	1943029	1948692	1954066	1959150	1963941	1968438	1972641	1976547	1980156	1983466	34
35	43126	48784	54153	59232	64018	68511	72708	76610	80214	83519	35
36	43223	48876	54240	59314	64095	68583	72776	76672	80271	83572	36
37	1943319	1948968	1954327	1959396	1964173	1968656	1972843	1976735	1980329	1983624	37
38	43416	49060	54414	59478	64250	68728	72911	76797	80386	83676	38
39	43512	49151	54501	59560	64327	68800	72978	76859	80443	83729	39
40	1943609	1949243	1954588	1959642	1964404	1968872	1973045	1976922	1980501	1983781	40
41	43705	49334	54674	59724	64481	68944	73112	76984	80558	83833	41
42	43801	49426	54761	59805	64557	69016	73179	77046	80615	83885	42
43	1943897	1949517	1954847	1959887	1964634	1969088	1973246	1977108	1980672	1983937	43
44	43993	49608	54934	59968	64711	69159	73313	77169	80729	83989	44
45	44089	49699	55020	60050	64787	69231	73379	77231	80785	84041	45
46	1944185	1949790	1955106	1960131	1964864	1969302	1973446	1977293	1980842	1984092	46
47	44281	49881	55192	60213	64940	69374	73512	77354	80899	84144	47
48	44376	49972	55278	60294	65016	69445	73579	77416	80955	84196	48
49	1944472	1950063	1955364	1960375	1965093	1969517	1973645	1977477	1981012	1984247	49
50	44568	50154	55450	60456	65169	69588	73712	77539	81068	84299	50
51	44663	50244	55536	60537	65245	69659	73778	77600	81124	84350	51
52	1944758	1950335	1955622	1960618	1965321	1969730	1973844	1977661	1981181	1984401	52
53	44854	50425	55707	60698	65397	69801	73910	77722	81237	84452	53
54	44949	50516	55793	60779	65473	69872	73976	77783	81293	84503	54
55	1945044	1950606	1955879	1960860	1965548	1969943	1974042	1977844	1981349	1984554	55
56	45139	50696	55964	60940	65624	70014	74108	77905	81405	84605	56
57	45234	50787	56049	61021	65700	70084	74173	77966	81460	84656	57
58	1945329	1950877	1956135	1961101	1965775	1970155	1974239	1978026	1981516	1984707	58
59	45424	50967	56220	61182	65850	70225	74305	78087	81572	84757	59
60	45519	51057	56305	61262	65926	70296	74370	78148	81627	84808	60

Parts for Seconds.

(v.)

°	160°		161°		162°		163°		164°		165°		166°		167°		168°		169°		170°	
	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'
1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
3	5	5	5	5	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3
4	7	6	6	6	6	6	6	6	5	5	5	5	5	4	4	4	4	4	4	3	4	4
5	8	8	8	8	7	7	7	7	7	6	6	6	6	5	5	5	5	5	4	4	5	5
6	10	10	9	9	9	9	9	8	8	8	8	7	7	7	7	6	6	6	5	5	6	6
7	12	11	11	11	10	10	10	10	9	9	9	8	8	8	8	7	7	6	6	6	7	7
8	13	13	13	12	12	12	11	11	11	10	10	10	9	9	9	8	8	8	7	7	8	8
9	15	15	14	14	13	13	13	12	12	11	11	11	10	10	9	9	9	8	8	8	9	9
10	17	16	16	15	15	15	14	14	13	13	13	12	12	11	11	10	10	9	9	8	10	10
11	18	18	17	17	16	16	16	15	15	14	14	13	13	12	12	12	11	11	10	10	9	11
12	20	19	19	18	18	17	17	17	16	16	15	15	14	14	13	13	12	12	11	11	10	12
13	22	21	21	20	19	19	18	18	17	17	16	16	15	15	14	14	13	13	12	11	11	13
14	23	23	22	22	21	20	20	19	19	18	18	17	16	16	15	15	14	14	13	12	12	14
15	25	24	24	23	22	22	21	21	20	19	19	18	18	17	16	16	15	15	14	13	13	15
16	27	26	25	25	24	23	23	22	21	21	20	19	19	18	17	17	16	15	15	14	13	16
17	28	28	27	26	25	25	24	23	23	22	21	21	20	19	19	18	17	16	16	15	14	17
18	30	29	28	28	27	26	26	25	24	23	23	22	21	20	20	19	18	17	17	16	15	18
19	32	31	30	29	28	28	27	26	25	25	24	23	22	22	21	20	19	18	18	17	16	19
20	33	32	32	31	30	29	28	28	27	26	25	24	23	23	22	21	20	19	19	18	17	20
21	35	34	33	33	32	31	30	29	28	27	26	25	25	24	23	22	21	20	19	19	18	21
22	36	36	35	34	33	32	31	30	29	28	28	27	26	25	24	23	22	21	20	19	19	22
23	38	37	36	35	34	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	23
24	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	24
25	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	25
26	43	42	41	40	39	38	37	36	35	34	33	32	31	29	28	27	26	25	24	23	22	26
27	45	44	43	42	41	39	38	37	36	35	34	33	32	31	29	28	27	26	25	24	23	27
28	46	45	44	43	42	41	40	39	37	36	35	34	33	32	31	29	28	27	26	25	24	28
29	48	47	46	45	43	42	41	40	39	38	36	35	34	33	32	30	29	28	27	26	24	29
30	50	49	47	46	45	44	43	41	40	39	38	36	35	34	33	31	30	29	28	27	25	30
31	51	50	49	48	46	45	44	43	41	40	39	38	36	35	34	33	31	30	29	27	26	31
32	53	52	51	49	48	47	45	44	43	41	40	39	38	36	35	34	32	31	30	28	27	32
33	55	53	52	51	49	48	47	45	44	43	41	40	39	37	36	35	33	32	31	29	28	33
34	56	55	54	52	51	50	48	47	45	44	43	41	40	38	37	36	34	33	31	30	29	34
35	58	57	55	54	52	51	50	48	47	45	44	42	41	40	38	37	35	34	32	31	29	35
36	60	58	57	55	54	52	51	50	48	47	45	44	42	41	39	38	36	35	33	32	30	36
37	61	60	58	57	55	54	52	51	49	48	46	45	43	42	40	39	37	36	34	33	31	37
38	63	61	60	58	57	55	54	52	51	49	48	46	45	43	41	40	38	37	35	34	32	38
39	65	63	62	60	58	57	55	54	52	50	49	47	46	44	43	41	39	38	36	34	33	39
40	66	65	63	62	60	58	57	55	53	52	50	49	47	45	44	42	40	39	37	35	34	40
41	68	66	65	63	61	60	58	56	55	53	51	50	48	46	45	43	41	40	38	36	35	41
42	70	68	66	65	63	61	60	58	56	54	53	51	49	48	46	44	42	41	39	37	35	42
43	71	70	68	66	65	63	61	59	57	56	54	52	50	49	47	45	43	42	40	38	36	43
44	73	71	69	68	66	64	62	61	59	57	55	53	52	50	48	46	44	43	41	39	37	44
45	75	73	71	69	67	66	64	62	60	58	56	55	53	51	49	47	45	44	42	40	38	45
46	76	74	73	71	69	67	65	63	61	60	58	56	54	52	50	48	46	44	43	41	39	46
47	78	76	74	72	70	69	67	65	63	61	59	57	55	53	51	49	47	45	43	42	40	47
48	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	48
49	81	79	77	75	73	71	69	68	65	63	61	59	57	55	53	51	49	47	45	43	41	49
50	83	80	79	77	75	73	71	69	67	65	63	61	59	57	55	52	50	48	46	44	42	50
51	85	83	80	78	76	74	72	70	68	66	64	62	60	58	56	54	51	49	46	45	43	51
52	86	84	82	80	78	76	74	72	69	67	65	63	61	59	57	55	52	50	48	46	44	52
53	88	86	84	82	79	77	75	73	71	69	67	64	62	60	58	56	53	51	48	47	45	53
54	90	87	85	83	80	79	77	74	72	70	68	66	63	61	59	57	54	52	50	48	45	54
55	91	89	87	85	82	80	78	76	73	71	69	67	65	62	60	58	55	53	51	49	46	55
56	93	91	88	86	84	82	79	77	74	72	70	68	66	63	61	59	56	54	51	49	47	56
57	95	92	90	88	85	83	81	78	76	74	72	69	67	65	62	60	57	55	52	50	48	57
58	96	94	92	89	87	85	82	80	77	75	73	70	68	66	63	61	58	56	53	51	49	58
59	98	95	93	91	88	86	84	81	79	76	74	72	69	67	64	62	59	57	54	52	50	59
60	99	97	95	92	90	87	85	83	80	78	75	73	70	68	65	63	60	58	55	53	50	60

(v.)

Nat. Versines.

	170°	171°	172°	173°	174°	175°	176°	177°	178°	179°	
0	1984808	1987688	1990268	1992546	1994522	1996195	1997564	1998630	1999391	1999848	0
1	1984858	1987734	1990309	1992582	1994552	1996220	1997584	1998645	1999401	1999853	1
2	84909	87779	90349	92617	94583	96245	97605	98660	99411	99858	2
3	84959	87825	90389	92652	94613	96270	97625	98675	99421	99863	3
4	1985009	1987870	1990429	1992687	1994643	1996295	1997645	1998690	1999431	1999867	4
5	85059	87915	90469	92722	94673	96320	97665	98705	99441	99872	5
6	85109	87960	90510	92757	94703	96345	97684	98719	99450	99877	6
7	1985159	1988005	1990549	1992792	1994733	1996370	1997704	1998734	1999460	1999881	7
8	85209	88050	90589	92827	94763	96395	97724	98749	99469	99886	8
9	85259	88095	90629	92862	94792	96420	97743	98763	99479	99890	9
10	1985309	1988139	1990669	1992896	1994822	1996444	1997763	1998778	1999488	1999894	10
11	85358	88184	90708	92931	94851	96469	97782	98792	99497	99898	11
12	85408	88228	90748	92966	94881	96493	97802	98806	99507	99903	12
13	1985457	1988273	1990787	1993000	1994910	1996517	1997821	1998820	1999516	1999907	13
14	85507	88317	90827	93034	94939	96541	97840	98834	99525	99911	14
15	85556	88362	90866	93069	94969	96566	97859	98848	99534	99914	15
16	1985605	1988406	1990905	1993103	1994998	1996590	1997878	1998862	1999542	1999918	16
17	85654	88450	90944	93137	95027	96614	97897	98876	99551	99922	17
18	85704	88494	90983	93171	95056	96637	97916	98890	99560	99925	18
19	1985752	1988538	1991022	1993205	1995084	1996661	1997934	1998904	1999568	1999929	19
20	85801	88582	91061	93238	95113	96685	97953	98917	99577	99932	20
21	85850	88626	91100	93272	95142	96709	97972	98931	99585	99936	21
22	1985899	1988669	1991138	1993306	1995171	1996732	1997990	1998944	1999594	1999939	22
23	85948	88713	91177	93339	95199	96756	98008	98957	99602	99942	23
24	85996	88756	91216	93373	95227	96779	98027	98971	99610	99945	24
25	1986045	1988800	1991254	1993406	1995256	1996802	1998045	1998984	1999618	1999948	25
26	86093	88843	91292	93440	95284	96825	98063	98997	99626	99951	26
27	86141	88887	91331	93473	95312	96849	98081	99010	99634	99954	27
28	1986189	1988930	1991369	1993506	1995340	1996872	1998099	1999023	1999642	1999957	28
29	86238	88973	91407	93539	95368	96895	98117	99036	99650	99959	29
30	86286	89016	91445	93572	95396	96917	98135	99048	99657	99962	30
31	1986334	1989059	1991483	1993605	1995424	1996940	1998153	1999061	1999665	1999964	31
32	86382	89102	91521	93638	95452	96963	98170	99073	99672	99967	32
33	86429	89145	91558	93670	95480	96985	98188	99086	99680	99969	33
34	1986477	1989187	1991596	1993703	1995507	1997008	1998205	1999098	1999687	1999971	34
35	86525	89230	91634	93736	95535	97030	98223	99111	99694	99974	35
36	86572	89272	91671	93768	95562	97053	98240	99123	99702	99976	36
37	1986620	1989315	1991709	1993800	1995589	1997075	1998257	1999135	1999709	1999978	37
38	86667	89357	91746	93833	95617	97097	98274	99147	99716	99980	38
39	86714	89399	91783	93865	95644	97119	98291	99159	99722	99981	39
40	1986762	1989442	1991820	1993897	1995671	1997141	1998308	1999171	1999729	1999983	40
41	86809	89484	91857	93929	95698	97163	98325	99183	99736	99985	41
42	86856	89526	91894	93961	95725	97185	98342	99194	99743	99986	42
43	1986903	1989568	1991931	1993993	1995752	1997207	1998359	1999206	1999749	1999988	43
44	86950	89610	91968	94025	95778	97229	98375	99218	99756	99989	44
45	86996	89651	92005	94056	95805	97250	98392	99229	99762	99991	45
46	1987043	1989693	1992042	1994088	1995832	1997272	1998408	1999240	1999768	1999992	46
47	87090	89735	92078	94120	95858	97293	98425	99252	99775	99993	47
48	87136	89776	92115	94151	95884	97315	98441	99263	99781	99994	48
49	1987183	1989818	1992151	1994182	1995911	1997336	1998457	1999274	1999787	1999995	49
50	87229	89859	92187	94214	95937	97357	98473	99285	99793	99996	50
51	87275	89900	92224	94245	95963	97378	98489	99296	99799	99997	51
52	1987322	1989942	1992260	1994276	1995989	1997399	1998505	1999307	1999804	1999997	52
53	87368	89983	92296	94307	96015	97420	98521	99318	99810	99998	53
54	87414	90024	92332	94338	96041	97441	98537	99328	99816	99999	54
55	1987460	1990065	1992368	1994369	1996067	1997462	1998552	1999339	1999821	1999999	55
56	87506	90106	92404	94400	96093	97482	98568	99350	99827	99999	56
57	87551	90146	92439	94430	96118	97503	98584	99360	99832	2000000	57
58	1987597	1990187	1992475	1994461	1996144	1997523	1998599	1999370	1999837	2000000	58
59	87643	90228	92511	94491	96169	97544	98614	99381	99843	00000	59
60	87688	90268	92546	94522	96195	97564	98630	99391	99848	00000	60

Parts for Seconds.

(v.)

	170°		171°		172°		173°		174°		175°		176°		177°		178°		179°		180°	
"	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'	0'	30'
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	0	0	0	0	0	3
4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	0	0	0	0	0	4
5	4	4	4	4	3	3	3	3	2	2	2	2	1	1	1	1	1	0	0	0	0	5
6	5	5	4	4	4	4	3	3	3	3	2	2	2	1	1	1	1	0	0	0	0	6
7	6	6	5	5	5	4	4	3	3	3	3	2	2	2	1	1	1	1	0	0	0	7
8	7	6	6	6	6	5	5	4	4	4	3	3	2	2	2	1	1	1	0	0	0	8
9	8	7	7	6	6	6	5	5	4	4	4	3	3	2	2	1	1	1	0	0	0	9
10	8	8	8	7	7	6	6	5	5	5	4	4	3	3	2	2	2	1	1	0	0	10
11	9	9	8	8	7	7	6	6	6	5	5	4	4	3	3	2	2	1	1	0	0	11
12	10	10	9	9	8	8	7	7	6	6	5	5	4	3	3	2	2	1	1	0	0	12
13	11	10	10	9	9	8	8	7	7	6	5	5	4	4	3	3	2	2	1	0	0	13
14	12	11	11	10	9	9	8	8	7	6	6	5	5	4	3	3	2	2	1	0	0	14
15	13	12	11	11	10	9	9	8	8	7	6	6	5	4	4	3	2	2	1	1	0	15
16	13	13	12	11	11	10	9	9	8	7	7	6	5	5	4	3	3	2	1	1	0	16
17	14	14	13	12	11	11	10	9	9	8	7	6	6	5	4	4	3	2	1	1	0	17
18	15	14	14	13	12	11	11	10	9	8	8	7	6	5	5	4	3	2	1	1	0	18
19	16	15	14	14	13	12	11	10	10	9	8	7	6	6	5	4	3	2	2	1	0	19
20	17	16	15	14	13	12	11	10	10	9	8	8	7	6	5	4	3	2	2	1	0	20
21	18	17	16	15	14	13	12	11	11	10	9	8	7	6	5	4	3	3	2	1	0	21
22	19	18	17	16	15	14	13	12	11	10	9	8	7	6	6	5	4	3	2	1	0	22
23	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	0	23
24	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	24
25	21	20	19	18	17	16	15	14	13	12	11	9	8	7	6	5	4	3	2	1	0	25
26	22	21	20	19	17	16	15	14	13	12	11	10	9	8	7	5	4	3	2	1	0	26
27	23	22	20	19	18	17	16	15	14	12	11	10	9	8	7	6	5	3	2	1	0	27
28	24	22	21	20	19	18	16	15	14	13	12	11	9	8	7	6	5	3	2	1	0	28
29	24	23	22	21	19	18	17	16	15	13	12	11	10	9	7	6	5	4	2	1	0	29
30	25	24	23	21	20	19	18	16	15	14	13	11	10	9	8	6	5	4	2	1	0	30
31	26	25	23	22	21	20	18	17	16	14	13	12	10	9	8	7	5	4	3	1	0	31
32	27	26	24	23	22	20	19	17	16	15	13	12	11	9	8	7	5	4	3	1	0	32
33	28	26	25	24	22	21	19	18	17	15	14	12	11	10	8	7	6	4	3	1	0	33
34	29	27	26	24	23	21	20	19	17	16	14	13	11	10	9	7	6	4	3	1	0	34
35	29	28	26	25	24	22	21	19	18	16	15	13	12	10	9	7	6	4	3	1	0	35
36	30	29	27	26	24	23	21	20	18	17	15	14	12	11	9	8	6	5	3	1	0	36
37	31	30	28	26	25	23	22	20	19	17	16	14	12	11	9	8	6	5	3	1	0	37
38	32	30	29	27	26	24	22	21	19	18	16	14	13	11	10	8	6	5	3	2	0	38
39	33	31	30	28	26	25	23	21	20	18	16	15	13	11	10	8	7	5	3	2	0	39
40	34	32	30	29	27	25	24	22	20	18	17	15	13	12	10	8	7	5	3	2	0	40
41	35	33	31	29	28	26	24	22	21	19	17	16	14	12	10	9	7	5	3	2	0	41
42	35	34	32	30	28	27	25	23	21	19	18	16	14	12	11	9	7	5	3	2	0	42
43	36	34	33	31	29	27	25	24	22	20	18	16	14	13	11	9	7	5	4	2	0	43
44	37	35	33	31	30	28	26	24	22	20	19	17	15	13	11	9	7	6	4	2	0	44
45	38	36	34	32	30	28	27	25	23	21	19	17	15	13	11	9	8	6	4	2	0	45
46	39	37	35	33	31	29	27	25	23	21	19	17	16	14	12	10	8	6	4	2	0	46
47	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0	47
48	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0	48
49	41	39	37	35	33	31	29	27	25	23	21	19	16	14	12	10	8	6	4	2	0	49
50	42	40	38	36	34	32	29	27	25	23	21	19	17	15	13	10	8	6	4	2	0	50
51	43	41	39	36	34	32	30	28	26	24	21	19	17	15	13	11	9	6	4	2	0	51
52	44	42	39	37	35	33	31	28	26	24	22	20	18	15	13	11	9	7	4	2	0	52
53	45	42	40	38	36	33	31	29	27	25	22	20	18	16	13	11	9	7	4	2	0	53
54	45	43	41	39	36	34	32	30	27	25	23	20	18	16	14	11	9	7	4	2	0	54
55	46	44	42	39	37	35	32	30	28	25	23	21	19	16	14	12	9	7	5	2	0	55
56	47	45	42	40	38	35	33	31	28	26	24	21	19	17	14	12	9	7	5	2	0	56
57	48	46	43	41	38	36	34	31	29	26	24	22	19	17	14	12	10	7	5	2	0	57
58	49	46	44	42	39	37	34	32	29	27	24	22	20	17	15	12	10	7	5	2	0	58
59	50	47	45	42	40	37	35	32	30	27	25	22	20	17	15	12	10	7	5	2	0	59
60	50	48	45	43	40	38	35	33	30	28	25	23	20	18	15	13	10	8	5	2	0	60

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (4° and 5°)

App Alt.	Minutes of Moon's Hor. Parallax.																		Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'											"	Δ
4°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	1	0
0'	42 1	1 17	43 1	1 20	44 1	1 23	45 0	1 26	46 0	1 29	47 0	1 32	48 0	1 34	49 0	1 37	3	2	0	0
2	42 5	1 18	43 5	1 21	44 5	1 24	45 4	1 27	46 4	1 30	47 4	1 33	48 4	1 36	49 4	1 38	3	3	0	0
4	42 9	1 19	43 9	1 22	44 9	1 25	45 9	1 28	46 8	1 31	47 8	1 34	48 8	1 37	49 8	1 40	5	5	0	0
6	42 13	1 20	43 13	1 23	44 13	1 26	45 13	1 29	46 12	1 32	47 12	1 35	48 12	1 38	49 12	1 41	6	6	0	0
8	42 17	1 21	43 17	1 24	44 17	1 27	45 17	1 30	46 17	1 33	47 16	1 36	48 16	1 39	49 16	1 42	7	7	0	0
10	42 21	1 22	43 21	1 25	44 21	1 28	45 21	1 31	46 21	1 34	47 20	1 37	48 20	1 40	49 20	1 43	8	8	0	0
12	42 25	1 23	43 25	1 27	44 25	1 29	45 25	1 32	46 25	1 35	47 24	1 38	48 24	1 41	49 24	1 44	10	10	0	0
14	42 29	1 23	43 29	1 28	44 29	1 31	45 29	1 34	46 29	1 37	47 29	1 40	48 28	1 43	49 28	1 46	11	11	0	0
16	42 33	1 26	43 33	1 29	44 33	1 32	45 33	1 35	46 33	1 38	47 33	1 41	48 32	1 44	49 32	1 47	12	12	0	0
18	42 37	1 27	43 37	1 30	44 37	1 33	45 37	1 36	46 37	1 39	47 37	1 42	48 37	1 45	49 36	1 48	13	13	0	0
20	42 41	1 28	43 41	1 31	44 41	1 34	45 41	1 37	46 41	1 40	47 41	1 43	48 41	1 46	49 40	1 49	14	14	0	0
22	42 45	1 29	43 45	1 32	44 45	1 35	45 45	1 38	46 45	1 41	47 44	1 44	48 44	1 47	49 44	1 51	15	15	0	0
24	42 49	1 30	43 49	1 33	44 48	1 36	45 48	1 39	46 48	1 42	47 48	1 45	48 48	1 49	49 48	1 52	16	16	0	0
26	42 52	1 31	43 52	1 34	44 52	1 37	45 52	1 40	46 52	1 43	47 52	1 47	48 52	1 50	49 51	1 53	17	17	0	0
28	42 56	1 32	43 56	1 35	44 56	1 38	45 56	1 41	46 55	1 45	47 55	1 48	48 55	1 51	49 55	1 54	18	18	0	0
30	43 0	1 33	44 0	1 36	44 59	1 39	45 59	1 43	46 59	1 46	47 59	1 49	48 59	1 52	49 59	1 55	19	19	0	0
32	43 3	1 34	44 3	1 37	45 3	1 41	46 3	1 44	47 3	1 47	48 3	1 50	49 2	1 53	50 2	1 57	20	20	0	0
34	43 7	1 35	44 7	1 38	45 7	1 42	46 7	1 45	47 6	1 48	48 6	1 51	49 6	1 55	50 6	1 58	21	21	0	0
36	43 11	1 36	44 11	1 40	45 10	1 43	46 10	1 46	47 10	1 49	48 10	1 52	49 10	1 56	50 10	1 59	22	22	0	0
38	43 14	1 37	44 14	1 41	45 14	1 44	46 14	1 47	47 14	1 50	48 13	1 54	49 13	1 57	50 13	2 0	23	23	0	0
40	43 18	1 38	44 18	1 42	45 18	1 45	46 17	1 48	47 17	1 51	48 17	1 55	49 17	1 58	50 17	2 1	24	24	0	0
42	43 21	1 39	44 21	1 43	45 21	1 46	46 21	1 49	47 21	1 53	48 20	1 56	49 20	1 59	50 20	2 2	25	25	0	0
44	43 24	1 41	44 24	1 44	45 24	1 47	46 24	1 50	47 24	1 54	48 24	1 57	49 23	2 0	50 23	2 3	26	26	0	0
46	43 28	1 42	44 28	1 45	45 27	1 48	46 27	1 52	47 27	1 55	48 27	1 58	49 27	2 1	50 26	2 4	27	27	0	0
48	43 31	1 43	44 31	1 46	45 31	1 49	46 30	1 53	47 30	1 56	48 30	1 59	49 30	2 3	50 30	2 6	28	28	0	0
50	43 34	1 44	44 34	1 47	45 34	1 50	46 34	1 54	47 33	1 57	48 33	2 0	49 33	2 4	50 33	2 7	29	29	0	0
52	43 37	1 45	44 37	1 48	45 37	1 52	46 37	1 55	47 37	1 58	48 36	2 2	49 36	2 5	50 36	2 9	30	30	0	0
54	43 41	1 46	44 40	1 49	45 40	1 53	46 40	1 56	47 40	2 0	48 40	2 3	49 40	2 6	50 39	2 10	31	31	0	0
56	43 44	1 47	44 44	1 50	45 44	1 54	46 43	1 57	47 43	2 1	48 43	2 4	49 43	2 8	50 43	2 11	32	32	0	0
58	43 47	1 48	44 47	1 51	45 47	1 55	46 47	1 58	47 46	2 2	48 46	2 5	49 46	2 9	50 46	2 12	33	33	0	0
5°	54'	55'	56'	57'	58'	59'	60'	61'											34	34
0'	43 50	1 49	44 50	1 52	45 50	1 56	46 50	1 59	47 50	2 3	48 49	2 6	49 49	2 10	50 49	2 13	35	35	0	0
2	43 53	1 50	44 53	1 54	45 53	1 57	46 53	2 1	47 53	2 4	48 52	2 8	49 52	2 11	50 52	2 15	36	36	0	0
4	43 56	1 51	44 56	1 55	45 56	1 58	46 56	2 2	47 55	2 5	48 55	2 9	49 55	2 12	50 55	2 16	37	37	0	0
6	43 59	1 52	44 59	1 56	45 59	1 59	46 59	2 3	47 58	2 6	48 58	2 10	49 58	2 14	50 58	2 17	38	38	0	0
8	44 2	1 53	45 2	1 57	46 2	2 0	47 2	2 4	48 2	2 8	49 1	2 11	50 1	2 15	51 1	2 18	39	39	0	0
10	44 5	1 54	45 5	1 58	46 5	2 2	47 4	2 5	48 4	2 9	49 4	2 12	50 4	2 16	51 4	2 20	40	40	0	0
12	44 8	1 55	45 8	1 59	46 8	2 3	47 7	2 6	48 7	2 10	49 7	2 14	50 7	2 17	51 7	2 21	41	41	0	0
14	44 11	1 56	45 11	2 0	46 10	2 4	47 10	2 7	48 10	2 11	49 10	2 15	50 10	2 18	51 9	2 22	42	42	0	0
16	44 14	1 58	45 14	2 1	46 13	2 5	47 13	2 9	48 13	2 12	49 13	2 16	50 13	2 20	51 12	2 23	43	43	0	0
18	44 17	1 59	45 17	2 2	46 16	2 6	47 16	2 10	48 16	2 13	49 16	2 17	50 15	2 21	51 15	2 24	44	44	0	0
20	44 20	2 0	45 19	2 3	46 19	2 7	47 19	2 11	48 19	2 14	49 19	2 18	50 18	2 22	51 18	2 26	45	45	0	0
22	44 22	2 1	45 23	2 4	46 22	2 8	47 22	2 12	48 21	2 16	49 21	2 19	50 21	2 23	51 21	2 27	46	46	0	0
24	44 25	2 2	45 25	2 6	46 25	2 9	47 24	2 13	48 24	2 17	49 24	2 21	50 24	2 24	51 24	2 28	47	47	0	0
26	44 27	2 3	45 28	2 7	46 27	2 10	47 27	2 14	48 27	2 18	49 27	2 22	50 26	2 25	51 26	2 29	48	48	0	0
28	44 31	2 4	45 31	2 8	46 30	2 12	47 30	2 15	48 30	2 19	49 29	2 23	50 29	2 27	51 29	2 31	49	49	0	0
30	44 33	2 5	45 33	2 9	46 33	2 13	47 33	2 17	48 32	2 20	49 32	2 24	50 32	2 28	51 32	2 32	50	50	0	0
32	44 36	2 6	45 36	2 10	46 36	2 14	47 35	2 18	48 35	2 21	49 35	2 25	50 34	2 29	51 34	2 33	51	51	0	0
34	44 39	2 7	45 39	2 11	46 38	2 15	47 38	2 19	48 38	2 23	49 37	2 26	50 37	2 30	51 37	2 34	52	52	0	0
36	44 42	2 8	45 41	2 12	46 41	2 16	47 41	2 20	48 40	2 24	49 40	2 28	50 40	2 31	51 40	2 35	53	53	0	0
38	44 44	2 9	45 44	2 13	46 44	2 17	47 43	2 21	48 43	2 25	49 43	2 29	50 43	2 33	51 42	2 37	54	54	0	0
40	44 47	2 10	45 47	2 14	46 46	2 18	47 46	2 22	48 45	2 26	49 45	2 30	50 45	2 34	51 45	2 38	55	55	0	0
42	44 49	2 12	45 49	2 15	46 49	2 19	47 48	2 23	48 48	2 27	49 48	2 31	50 48	2 35	51 47	2 39	56	56	0	0
44	44 52	2 13	45 51	2 17	46 51	2 21	47 51	2 24	48 51	2 28	49 50	2 32	50 50	2 36	51 50	2 40	57	57	0	0
46	44 54	2 14	45 54	2 18	46 54	2 22	47 53	2 26	48 53	2 30	49 53	2 34	50 52	2 37	51 52	2 42	58	58	0	0
48	44 57	2 15	45 56	2 19	46 56	2 23	47 56	2 27	48 55	2 31	49 55	2 35	50 55	2 39	51 55	2 43	59	59	0	0
50	44 59	2 16	45 59	2 20	46 58	2 24	47 58	2 28	48 58	2 32	49 57	2 36	50 57	2 40	51 57	2 44	60	60	0	0
52	45 1	2 17	46 1	2 21	47 1	2 25	48 0	2 29	49 0	2 33	50 0	2 37	51 0	2 41	51 59	2 45	61	61	0	0
54	45 4	2 18	46 3	2 22	47 3	2 26	48 3	2 30	49 3	2 34	50 2	2 38	51 2	2 42	52 2	2 46	62	62	0	0
56	45 6	2 19	46 6	2 23	47 6	2 27	48 5	2 31	49 5	2 35	50 5	2 39	51 4	2 43	52 4	2 47	63	63	0	0
58	45 9	2 20	46 8	2 24	47 8	2 28	48 8	2 32	49 7	2 37	50 7	2 41	51 7	2 45	52 7	2 49	64	64	0	0

(6° and 7°)		The Correction of the Moon's Altitude, and the Aux. Angle A.																(w.)	
App. Alt.	6°	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
		54'		55'		56'		57'		58'		59'		60'		61'		Cor.	A
		Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A		
		+	60"	+	60"	+	60"	+	60"	+	60"	+	60"	+	60"	+	60"	1	0
0'	45 11	2 21	46 11	2 25	47 10	2 30	48 10	2 34	49 10	2 38	50 10	2 42	51 9	2 46	52 9	2 50	53 9	2	0
2	45 13	2 22	46 13	2 26	47 12	2 31	48 12	2 35	49 12	2 39	50 12	2 43	51 11	2 47	52 11	2 51	54 0	3	0
4	45 15	2 23	46 15	2 28	47 15	2 32	48 14	2 36	49 14	2 40	50 14	2 44	51 13	2 48	52 13	2 52	55 0	4	0
6	45 17	2 25	46 17	2 29	47 17	2 33	48 16	2 37	49 16	2 41	50 16	2 45	51 15	2 49	52 15	2 54	56 0	5	0
8	45 19	2 26	46 19	2 30	47 19	2 34	48 18	2 38	49 18	2 42	50 18	2 46	51 17	2 51	52 17	2 55	57 0	6	0
10	45 21	2 27	46 21	2 31	47 21	2 35	48 20	2 39	49 20	2 43	50 20	2 48	51 20	2 52	52 19	2 56	58 0	7	0
12	45 24	2 28	46 23	2 32	47 23	2 36	48 23	2 40	49 22	2 45	50 22	2 49	51 22	2 53	52 21	2 57	10 0	8	0
14	45 25	2 29	46 25	2 33	47 25	2 37	48 25	2 42	49 24	2 46	50 24	2 50	51 24	2 54	52 23	2 59	11 0	9	0
16	45 28	2 30	46 27	2 34	47 27	2 38	48 27	2 43	49 26	2 47	50 26	2 51	51 26	2 55	52 25	3 0	12 0	10	0
18	45 30	2 31	46 30	2 35	47 29	2 39	48 29	2 44	49 29	2 48	50 28	2 52	51 28	2 57	52 27	3 1	13 0	11	0
20	45 32	2 32	46 32	2 36	47 31	2 41	48 31	2 45	49 31	2 49	50 30	2 53	51 30	2 58	52 30	3 2	14 0	12	0
22	45 34	2 33	46 34	2 37	47 33	2 42	48 33	2 46	49 33	2 50	50 32	2 55	51 32	2 59	52 32	3 3	15 0	13	0
24	45 36	2 34	46 36	2 38	47 35	2 43	48 35	2 47	49 35	2 52	50 34	2 56	51 34	3 0	52 34	3 5	16 0	14	0
26	45 38	2 35	46 38	2 40	47 37	2 44	48 37	2 48	49 37	2 53	50 36	2 57	51 36	3 1	52 36	3 6	17 0	15	0
28	45 40	2 36	46 40	2 41	47 39	2 45	48 39	2 49	49 39	2 54	50 38	2 58	51 38	3 2	52 37	3 7	18 0	16	0
30	45 42	2 37	46 42	2 42	47 41	2 46	48 41	2 51	49 40	2 55	50 40	2 59	51 40	3 3	52 39	3 8	19 0	17	0
32	45 44	2 38	46 44	2 43	47 43	2 47	48 43	2 52	49 42	2 56	50 42	3 1	52 41	3 4	52 41	3 10	20 0	18	0
34	45 46	2 40	46 46	2 44	47 45	2 48	48 45	2 53	49 44	2 57	50 44	3 2	51 44	3 5	52 43	3 11	21 0	19	0
36	45 48	2 41	46 48	2 45	47 47	2 50	48 47	2 54	49 46	2 58	50 46	3 3	51 46	3 7	52 45	3 12	22 0	20	0
38	45 50	2 42	46 50	2 46	47 49	2 51	48 49	2 55	49 48	3 0	50 48	3 4	51 48	3 9	52 47	3 13	23 0	21	0
40	45 52	2 43	46 52	2 47	47 51	2 52	48 51	2 56	49 50	3 1	50 50	3 5	51 50	3 10	52 49	3 14	24 0	22	0
42	45 54	2 44	46 53	2 48	47 53	2 53	48 53	2 57	49 52	3 2	50 52	3 6	51 51	3 11	52 51	3 16	25 0	23	0
44	45 56	2 45	46 55	2 49	47 55	2 54	48 54	2 58	49 54	3 3	50 54	3 7	51 53	3 12	52 53	3 17	26 0	24	0
46	45 57	2 46	46 57	2 50	47 57	2 55	48 56	3 0	49 56	3 4	50 55	3 8	51 55	3 13	52 55	3 18	27 0	25	0
48	45 59	2 47	46 59	2 51	47 58	2 56	48 58	3 1	49 57	3 5	50 57	3 10	51 57	3 15	52 56	3 19	28 0	26	0
50	46 1	2 48	47 0	2 52	48 0	2 57	49 0	3 2	49 59	3 6	50 59	3 11	51 58	3 16	52 58	3 20	29 0	27	0
52	46 3	2 49	47 2	2 53	48 2	2 58	49 1	3 3	50 1	3 8	51 1	3 12	52 0	3 17	53 0	3 22	30 0	28	0
54	46 4	2 50	47 4	2 54	48 4	2 59	49 3	3 4	50 3	3 9	51 3	3 13	52 2	3 18	53 2	3 23	31 0	29	0
56	46 6	2 51	47 6	2 55	48 5	3 0	49 5	3 5	50 5	3 10	51 4	3 15	52 4	3 19	53 3	3 24	32 0	30	0
58	46 8	2 52	47 8	2 56	48 7	3 1	49 7	3 6	50 6	3 11	51 6	3 16	52 5	3 21	53 5	3 25	33 0	31	0
7°		54'	55'	56'	57'	58'	59'	60'	61'										
0'	46 10	2 53	47 9	2 57	48 9	3 2	49 8	3 7	50 8	3 12	51 8	3 17	52 7	3 22	53 7	3 27	41 0	3	0
2	46 11	2 54	47 11	2 58	48 11	3 3	49 10	3 8	50 10	3 13	51 9	3 18	52 9	3 23	53 8	3 28	42 0	4	0
4	46 13	2 55	47 13	3 0	48 12	3 5	49 12	3 10	50 11	3 14	51 11	3 19	52 10	3 24	53 10	3 29	43 0	5	0
6	46 15	2 56	47 14	3 1	48 14	3 6	49 13	3 11	50 13	3 16	51 12	3 20	52 12	3 25	53 12	3 30	44 0	6	0
8	46 16	2 57	47 16	3 2	48 16	3 7	49 15	3 12	50 15	3 17	51 14	3 22	52 14	3 27	53 13	3 31	45 0	7	0
10	46 18	2 58	47 18	3 3	48 17	3 8	49 17	3 13	50 16	3 18	51 16	3 23	52 15	3 28	53 15	3 33	46 0	8	0
12	46 20	3 0	47 19	3 5	48 19	3 9	49 18	3 14	50 18	3 19	51 17	3 24	52 17	3 29	53 17	3 34	47 0	9	0
14	46 21	3 1	47 21	3 6	48 20	3 11	49 20	3 16	50 20	3 20	51 19	3 25	52 19	3 30	53 18	3 35	50 0	10	0
16	46 23	3 2	47 23	3 7	48 22	3 12	49 22	3 17	50 21	3 22	51 21	3 26	52 20	3 31	53 20	3 36	51 0	11	0
18	46 25	3 3	47 24	3 8	48 24	3 13	49 23	3 18	50 23	3 23	51 22	3 28	52 22	3 33	53 21	3 38	52 0	12	0
20	46 26	3 4	47 26	3 9	48 25	3 14	49 25	3 19	50 24	3 24	51 23	3 29	52 23	3 34	53 23	3 39	53 0	13	0
22	46 28	3 5	47 27	3 10	48 27	3 15	49 26	3 20	50 26	3 25	51 25	3 30	52 25	3 35	53 24	3 40	55 0	14	0
24	46 29	3 7	47 29	3 11	48 28	3 16	49 28	3 21	50 27	3 26	51 27	3 31	52 26	3 36	53 26	3 41	56 0	15	0
26	46 31	3 8	47 30	3 13	48 30	3 18	49 29	3 23	50 29	3 27	51 28	3 32	52 28	3 37	53 27	3 42	57 0	16	0
28	46 32	3 9	47 32	3 14	48 31	3 19	49 31	3 24	50 30	3 29	51 30	3 34	52 29	3 39	53 29	3 44	58 0	17	0
30	46 34	3 10	47 33	3 15	48 33	3 20	49 32	3 25	50 32	3 30	51 31	3 35	52 31	3 40	53 30	3 45	59 0	18	0
32	46 35	3 11	47 35	3 16	48 34	3 21	49 34	3 26	50 33	3 31	51 33	3 36	52 32	3 41	53 32	3 46			
34	46 37	3 12	47 36	3 17	48 36	3 22	49 35	3 27	50 35	3 32	51 34	3 37	52 34	3 42	53 33	3 47			
36	46 38	3 13	47 38	3 18	48 37	3 23	49 36	3 28	50 36	3 33	51 35	3 38	52 35	3 43	53 34	3 49			
38	46 40	3 14	47 39	3 19	48 38	3 24	49 38	3 29	50 37	3 34	51 37	3 40	52 37	3 45	53 36	3 50			
40	46 41	3 15	47 40	3 20	48 40	3 25	49 39	3 30	50 39	3 36	51 38	3 41	52 38	3 46	53 37	3 51			
42	46 42	3 16	47 42	3 21	48 41	3 27	49 41	3 32	50 40	3 37	51 40	3 42	52 39	3 47	53 39	3 52			
44	46 43	3 17	47 43	3 22	48 43	3 28	49 42	3 33	50 42	3 38	51 41	3 43	52 41	3 48	53 40	3 53			
46	46 44	3 18	47 44	3 24	48 44	3 29	49 43	3 34	50 43	3 39	51 42	3 44	52 42	3 49	53 41	3 55			
48	46 46	3 19	47 46	3 25	48 45	3 30	49 45	3 35	50 44	3 40	51 44	3 45	52 43	3 51	53 43	3 56			
50	46 47	3 21	47 47	3 26	48 47	3 31	49 46	3 36	50 45	3 41	51 45	3 47	52 45	3 52	53 44	3 57			
52	46 48	3 22	47 48	3 27	48 48	3 32	49 47	3 37	50 47	3 42	51 46	3 48	52 46	3 53	53 45	3 58			
54	46 49	3 23	47 50	3 28	48 49	3 33	49 49	3 38	50 48	3 44	51 48	3 49	52 47	3 54	53 46	3 59			
56	46 50	3 24	47 51	3 29	48 51	3 34	49 50	3 40	50 49	3 45	51 49	3 50	52 48	3 55	53 48	4 0			

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (8° and 9°)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
8°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	46 54	3 26	47 54	3 31	48 53	3 36	49 53	3 42	50 52	3 47	51 51	3 52	52 51	3 58	53 50	4 3	1	0
2	46 55	3 27	47 55	3 32	48 54	3 38	49 54	3 43	50 53	3 48	51 53	3 54	52 52	3 59	53 51	4 4	2	0
4	46 57	3 28	47 56	3 33	48 55	3 39	49 55	3 44	50 54	3 49	51 54	3 55	52 53	4 0	53 53	4 6	3	0
6	46 58	3 29	47 57	3 34	48 57	3 40	49 56	3 45	50 55	3 51	51 55	3 56	52 54	4 1	53 54	4 7	4	0
8	46 59	3 30	47 58	3 36	48 58	3 41	49 57	3 46	50 56	3 52	51 56	3 57	52 55	4 2	53 55	4 8	5	0
10	47 0	3 31	47 59	3 37	48 59	3 42	49 58	3 47	50 57	3 53	51 57	3 58	52 56	4 3	53 56	4 9	6	0
12	47 1	3 32	48 0	3 38	49 0	3 43	49 59	3 49	50 58	3 54	51 58	3 59	52 58	4 5	53 57	4 10	7	0
14	47 2	3 33	48 1	3 39	49 1	3 44	50 0	3 50	50 59	3 55	51 59	4 1	52 59	4 6	53 58	4 11	8	0
16	47 3	3 34	48 2	3 40	49 2	3 45	50 1	3 51	51 0	3 56	52 0	4 2	53 0	4 7	53 59	4 12	9	0
18	47 4	3 36	48 4	3 41	49 3	3 47	50 3	3 52	51 1	3 57	52 1	4 3	53 1	4 8	54 0	4 14	10	0
20	47 6	3 37	48 5	3 42	49 4	3 48	50 4	3 53	51 3	3 59	52 3	4 4	53 2	4 10	54 1	4 15	11	0
22	47 7	3 38	48 6	3 43	49 6	3 49	50 5	3 54	51 4	4 0	52 4	4 5	53 3	4 11	54 2	4 16	12	0
24	47 8	3 39	48 7	3 44	49 7	3 50	50 6	3 55	51 5	4 1	52 5	4 6	53 4	4 12	54 3	4 17	13	0
26	47 9	3 40	48 8	3 45	49 8	3 51	50 7	3 57	51 6	4 2	52 6	4 7	53 5	4 13	54 4	4 19	14	0
28	47 10	3 41	48 9	3 47	49 9	3 52	50 8	3 58	51 8	4 3	52 7	4 8	53 6	4 14	54 5	4 20	15	0
30	47 11	3 42	48 11	3 48	49 10	3 53	50 9	3 59	51 9	4 4	52 8	4 10	53 7	4 16	54 6	4 21	16	0
32	47 12	3 43	48 12	3 49	49 11	3 54	50 10	4 0	51 10	4 5	52 9	4 11	53 8	4 17	54 7	4 23	17	0
34	47 14	3 44	48 13	3 50	49 12	3 55	50 11	4 1	51 11	4 7	52 10	4 12	53 9	4 18	54 8	4 24	18	0
36	47 15	3 45	48 14	3 51	49 13	3 57	50 12	4 2	51 12	4 8	52 11	4 14	53 11	4 19	54 9	4 25	19	0
38	47 16	3 46	48 15	3 52	49 14	3 58	50 14	4 3	51 13	4 9	52 12	4 15	53 12	4 20	54 11	4 26	20	0
40	47 17	3 47	48 16	3 53	49 15	3 59	50 15	4 4	51 14	4 10	52 13	4 16	53 13	4 22	54 12	4 27	21	0
42	47 18	3 48	48 17	3 54	49 17	4 0	50 16	4 6	51 15	4 11	52 14	4 17	53 14	4 23	54 13	4 29	22	0
44	47 19	3 50	48 18	3 55	49 18	4 1	50 17	4 7	51 16	4 13	52 15	4 18	53 15	4 24	54 14	4 30	23	0
46	47 20	3 51	48 19	3 56	49 19	4 2	50 18	4 8	51 17	4 14	52 16	4 19	53 16	4 25	54 15	4 31	24	0
48	47 21	3 52	48 20	3 57	49 20	4 3	50 19	4 9	51 18	4 15	52 17	4 21	53 17	4 26	54 16	4 32	25	0
50	47 22	3 53	48 21	3 59	49 21	4 4	50 20	4 10	51 19	4 16	52 18	4 22	53 18	4 28	54 17	4 33	26	0
52	47 23	3 54	48 22	4 0	49 22	4 5	50 21	4 11	51 20	4 17	52 19	4 23	53 19	4 29	54 18	4 35	27	0
54	47 24	3 55	48 23	4 1	49 23	4 7	50 22	4 12	51 21	4 18	52 20	4 24	53 20	4 30	54 19	4 36	28	0
56	47 25	3 56	48 24	4 2	49 24	4 8	50 23	4 14	51 22	4 19	52 21	4 25	53 21	4 31	54 20	4 37	29	0
58	47 26	3 57	48 25	4 3	49 25	4 9	50 24	4 15	51 23	4 21	52 22	4 27	53 22	4 32	54 21	4 38	30	0
9°	54'		55'		56'		57'		58'		59'		60'		61'			
0'	47 27	3 58	48 26	4 4	49 26	4 10	50 25	4 16	51 24	4 22	52 23	4 28	53 23	4 34	54 22	4 40	31	0
2	47 28	3 59	48 27	4 5	49 27	4 11	50 26	4 17	51 25	4 23	52 24	4 29	53 24	4 35	54 23	4 41	32	0
4	47 29	4 0	48 28	4 6	49 28	4 12	50 27	4 18	51 26	4 24	52 25	4 30	53 25	4 36	54 24	4 42	33	0
6	47 30	4 1	48 29	4 7	49 29	4 13	50 28	4 19	51 27	4 25	52 26	4 31	53 26	4 37	54 25	4 43	34	0
8	47 31	4 2	48 30	4 8	49 30	4 14	50 29	4 20	51 28	4 26	52 27	4 32	53 27	4 38	54 26	4 44	35	0
10	47 32	4 3	48 31	4 10	49 30	4 16	50 30	4 22	51 29	4 28	52 28	4 34	53 27	4 40	54 27	4 46	36	0
12	47 33	4 5	48 32	4 11	49 31	4 17	50 31	4 23	51 30	4 29	52 29	4 35	53 28	4 41	54 28	4 47	37	0
14	47 34	4 6	48 33	4 12	49 32	4 18	50 32	4 24	51 31	4 30	52 30	4 36	53 29	4 42	54 29	4 48	38	0
16	47 35	4 7	48 34	4 13	49 33	4 19	50 33	4 25	51 32	4 31	52 31	4 37	53 30	4 43	54 30	4 49	39	0
18	47 36	4 8	48 35	4 14	49 34	4 20	50 34	4 26	51 33	4 32	52 32	4 38	53 31	4 44	54 31	4 51	40	0
20	47 37	4 9	48 36	4 15	49 35	4 21	50 35	4 27	51 34	4 34	52 33	4 39	53 32	4 46	54 32	4 52	41	0
22	47 38	4 10	48 37	4 16	49 36	4 22	50 35	4 28	51 35	4 35	52 34	4 41	53 33	4 47	54 33	4 53	42	0
24	47 39	4 11	48 38	4 17	49 37	4 23	50 36	4 30	51 35	4 36	52 35	4 42	53 34	4 48	54 34	4 54	43	0
26	47 39	4 12	48 39	4 18	49 38	4 25	50 37	4 31	51 36	4 37	52 35	4 43	53 35	4 49	54 34	4 55	44	0
28	47 40	4 13	48 39	4 19	49 39	4 26	50 38	4 32	51 37	4 38	52 36	4 44	53 35	4 50	54 35	4 57	45	0
30	47 41	4 14	48 40	4 21	49 39	4 27	50 39	4 33	51 38	4 39	52 37	4 45	53 36	4 52	54 35	4 58	46	0
32	47 42	4 15	48 41	4 22	49 40	4 28	50 39	4 34	51 38	4 40	52 38	4 47	53 37	4 53	54 36	4 59	47	0
34	47 43	4 16	48 42	4 23	49 41	4 29	50 40	4 35	51 39	4 41	52 38	4 48	53 38	4 54	54 37	5 0	48	0
36	47 43	4 18	48 43	4 24	49 42	4 30	50 41	4 36	51 40	4 43	52 39	4 49	53 38	4 55	54 38	5 1	49	0
38	47 44	4 19	48 43	4 25	49 42	4 31	50 42	4 37	51 41	4 44	52 40	4 50	53 39	4 56	54 38	5 2	50	0
40	47 45	4 20	48 44	4 26	49 43	4 32	50 42	4 39	51 41	4 45	52 41	4 51	53 40	4 57	54 39	5 3	51	0
42	47 46	4 21	48 45	4 27	49 44	4 33	50 43	4 40	51 42	4 46	52 41	4 52	53 40	4 59	54 40	5 4	52	0
44	47 46	4 22	48 45	4 28	49 45	4 35	50 44	4 41	51 43	4 47	52 42	4 54	53 41	5 0	54 40	5 6	53	0
46	47 47	4 23	48 46	4 29	49 45	4 36	50 44	4 42	51 43	4 48	52 43	4 55	53 42	5 1	54 41	5 8	54	0
48	47 48	4 24	48 47	4 30	49 46	4 37	50 45	4 43	51 44	4 49	52 43	4 56	53 42	5 2	54 42	5 9	55	0
50	47 48	4 25	48 47	4 31	49 46	4 38	50 46	4 44	51 45	4 51	52 44	4 57	53 43	5 3	54 42	5 10	56	0
52	47 49	4 26	48 48	4 33	49 47	4 39	50 46	4 45	51 45	4 52	52 45	4 58	53 44	5 4	54 43	5 11	57	0
54	47 50	4 27	48 49	4 34	49 48	4 40	50 47	4 47	51 46	4 53	52 45	4 59	53 44	5 5	54 43	5 12	58	0
56	47 50	4 28	48 49	4 35	49 49	4 41	50 48	4 48	51 47	4 54	52 46	5 1	53 45	5 7	54 44	5 14	59	0
58	47 51	4 29	48 50	4 36	49 49	4 42	50 48	4 49	51 47	4 55	52 47	5 2	53 46	5 8	54 45	5 15	60	0

(10° and 11°) The Correction of the Moon's Altitude, and the Aux. Angle A. (w.)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'				
	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	Cor.	A
10°																	1	"	"
0'	17 52	4 30 48 51	4 37 49 50	4 43 50 49	4 50 51 48	4 56 52 47	5 3 53 46	5 9 54 45	5 16	2	2	0	0				1	0	0
2	17 52	4 31 48 51	4 38 49 51	4 45 50 50	4 51 51 49	4 58 52 48	5 4 53 47	5 11 54 46	5 17	4	4	0	0				3	0	0
4	17 53	4 33 48 52	4 39 49 51	4 46 50 50	4 52 51 49	4 59 52 48	5 5 53 48	5 12 54 47	5 18	5	5	1	1				5	1	1
6	17 54	4 34 48 53	4 40 49 52	4 47 50 51	4 53 51 50	5 0 52 49	5 6 53 48	5 13 54 47	5 20	6	6	1	1				7	1	1
8	17 54	4 35 48 53	4 41 49 52	4 48 50 52	4 54 51 51	5 1 52 50	5 8 53 49	5 15 54 48	5 21	7	7	1	1				8	1	1
10	17 55	4 36 48 54	4 42 49 53	4 49 50 52	4 55 51 51	5 2 52 50	5 9 53 49	5 15 54 49	5 22	8	8	1	1				9	1	1
12	17 56	4 37 48 55	4 43 49 54	4 50 50 53	4 57 51 52	5 3 52 51	5 10 53 50	5 16 54 49	5 23	10	10	1	1				11	1	1
14	17 56	4 38 48 55	4 44 49 54	4 51 50 54	4 58 51 53	5 4 52 52	5 11 53 51	5 18 54 50	5 24	11	11	1	1				12	1	1
16	17 57	4 39 48 56	4 46 49 55	4 52 50 54	4 59 51 53	5 5 52 52	5 12 53 51	5 19 54 50	5 26	12	12	1	1				13	2	2
18	17 58	4 40 48 57	4 47 49 56	4 53 50 55	5 0 51 54	5 7 52 53	5 13 53 52	5 20 54 51	5 27	14	14	2	2				14	2	2
20	17 58	4 41 48 57	4 48 49 56	4 54 50 55	5 1 51 54	5 8 52 54	5 14 53 53	5 21 54 52	5 28	15	15	2	2				15	2	2
22	17 59	4 42 48 58	4 49 49 57	4 56 50 56	5 2 51 55	5 9 52 54	5 16 53 53	5 22 54 52	5 29	16	16	2	2				16	2	2
24	18 0	4 43 48 59	4 50 49 58	4 57 50 57	5 3 51 56	5 10 52 55	5 17 53 54	5 24 54 53	5 31	17	17	2	2				17	2	2
26	18 0	4 44 48 59	4 51 49 58	4 58 50 57	5 5 51 56	5 11 52 55	5 18 53 54	5 25 54 54	5 32	18	18	2	2				18	2	2
28	18 1	4 45 49 0	4 52 49 59	4 59 50 58	5 6 51 57	5 12 52 56	5 19 53 55	5 26 54 54	5 33	19	19	2	2				19	2	2
30	18 2	4 46 49 1	4 53 50 0	5 0 50 59	5 7 51 58	5 14 52 57	5 20 53 56	5 27 54 55	5 34	20	20	3	3				20	3	3
32	18 2	4 47 49 1	4 54 50 0	5 1 50 59	5 8 51 58	5 15 52 57	5 22 53 56	5 28 54 55	5 35	21	21	3	3				21	3	3
34	18 3	4 49 49 2	4 55 50 1	5 2 51 0	5 9 51 59	5 16 52 58	5 23 53 57	5 30 54 56	5 37	22	22	3	3				22	3	3
36	18 4	4 50 49 3	4 56 50 2	5 3 51 1	5 10 52 0	5 17 52 59	5 24 53 58	5 31 54 57	5 38	23	23	3	3				23	3	3
38	18 4	4 51 49 3	4 58 50 2	5 4 51 1	5 11 52 0	5 18 52 59	5 25 53 58	5 32 54 57	5 39	24	24	3	3				24	3	3
40	18 5	4 52 49 4	4 59 50 3	5 5 51 2	5 12 52 1	5 19 53 0	5 26 53 59	5 33 54 58	5 40	25	25	3	3				25	3	3
42	18 5	4 53 49 4	5 0 50 3	5 7 51 2	5 14 52 1	5 21 53 0	5 27 53 59	5 34 54 58	5 41	26	26	3	3				26	3	3
44	18 6	4 54 49 5	5 1 50 4	5 8 51 3	5 15 52 2	5 22 53 1	5 29 54 0	5 36 54 59	5 43	27	27	3	3				27	3	3
46	18 7	4 55 49 6	5 2 50 4	5 9 51 3	5 16 52 2	5 23 53 1	5 30 54 0	5 37 54 59	5 44	28	28	3	3				28	3	3
48	18 7	4 56 49 6	5 3 50 5	5 10 51 4	5 17 52 3	5 24 53 2	5 31 54 1	5 38 55 0	5 45	29	29	3	3				29	3	3
50	18 8	4 57 49 7	5 4 50 6	5 11 51 4	5 18 52 3	5 25 53 2	5 32 54 1	5 39 55 0	5 46	30	30	4	4				30	4	4
52	18 8	4 58 49 7	5 5 50 6	5 12 51 5	5 19 52 4	5 26 53 3	5 33 54 2	5 40 55 1	5 47	31	31	4	4				31	4	4
54	18 9	4 59 49 8	5 6 50 7	5 13 51 6	5 20 52 5	5 27 53 4	5 34 54 3	5 42 55 2	5 49	32	32	4	4				32	4	4
56	18 9	5 0 49 8	5 7 50 7	5 14 51 6	5 21 52 5	5 28 53 4	5 35 54 3	5 43 55 2	5 50	33	33	4	4				33	4	4
58	18 10	5 1 49 9	5 9 50 8	5 16 51 7	5 23 52 6	5 30 53 4	5 37 54 3	5 44 55 2	5 51	34	34	5	5				34	5	5
11°																	39	38	5
0	48 10	5 2 49 9	5 10 50 8	5 17 51 7	5 24 52 6	5 31 53 5	5 38 54 4	5 45 55 3	5 52	40	40	5	5				39	38	5
2	48 11	5 4 49 10	5 11 50 9	5 18 51 8	5 25 52 7	5 32 53 6	5 39 54 5	5 46 55 4	5 53	41	41	5	5				40	39	5
4	48 11	5 5 49 10	5 12 50 9	5 19 51 8	5 26 52 7	5 33 53 6	5 40 54 5	5 47 55 4	5 54	42	42	5	5				41	39	5
6	48 12	5 6 49 11	5 13 50 9	5 20 51 8	5 27 52 7	5 34 53 6	5 41 54 5	5 49 55 4	5 56	43	43	5	5				42	40	5
8	48 12	5 7 49 11	5 14 50 10	5 21 51 9	5 28 52 8	5 35 53 7	5 43 54 6	5 50 55 5	5 57	44	44	5	5				43	40	5
10	48 13	5 8 49 11	5 15 50 10	5 22 51 9	5 29 52 8	5 37 53 7	5 44 54 6	5 51 55 5	5 58	45	45	5	5				44	41	5
12	48 13	5 9 49 12	5 16 50 11	5 23 51 10	5 31 52 8	5 38 53 7	5 45 54 6	5 52 55 5	5 59	46	46	5	5				45	41	5
14	48 13	5 10 49 12	5 17 50 11	5 24 51 10	5 32 52 9	5 39 53 8	5 46 54 7	5 53 55 6	6 0	47	47	5	5				46	41	5
16	48 14	5 11 49 13	5 18 50 12	5 25 51 10	5 33 52 9	5 40 53 8	5 47 54 7	5 55 55 6	6 1	48	48	5	5				47	42	5
18	48 14	5 12 49 13	5 19 50 12	5 27 51 11	5 34 52 10	5 41 53 9	5 48 54 7	5 56 55 6	6 3	49	49	5	5				48	42	5
20	48 15	5 13 49 13	5 20 50 12	5 28 51 11	5 35 52 10	5 42 53 9	5 50 54 8	5 57 55 7	6 4	50	50	5	5				49	43	5
22	48 15	5 14 49 14	5 21 50 13	5 29 51 12	5 36 52 10	5 43 53 9	5 51 54 8	5 58 55 7	6 5	51	51	5	5				50	43	5
24	48 16	5 15 49 14	5 23 50 13	5 30 51 12	5 37 52 11	5 45 53 10	5 52 54 9	5 59 55 7	6 6	52	52	5	5				51	44	5
26	48 16	5 16 49 15	5 24 50 14	5 31 51 12	5 38 52 11	5 46 53 10	5 53 54 9	6 0 55 8	6 7	53	53	5	5				52	44	5
28	48 16	5 17 49 15	5 25 50 14	5 32 51 13	5 39 52 12	5 47 53 10	5 54 54 9	6 1 55 8	6 9	54	54	5	5				53	45	5
30	48 17	5 18 49 16	5 26 50 14	5 33 51 13	5 41 52 12	5 48 53 11	5 55 54 10	6 3 55 8	6 10	55	55	5	5				54	45	5
32	48 17	5 19 49 16	5 27 50 15	5 34 51 14	5 42 52 12	5 49 53 11	5 57 54 10	6 4 55 9	6 11	56	56	5	5				55	46	5
34	48 18	5 20 49 16	5 28 50 15	5 35 51 14	5 43 52 13	5 50 53 12	5 58 54 10	6 5 55 9	6 13	57	57	5	5				56	46	5
36	48 18	5 21 49 17	5 29 50 16	5 36 51 14	5 44 52 13	5 51 53 12	5 59 54 11	6 6 55 10	6 14	58	58	5	5				57	47	5
38	48 19	5 22 49 17	5 30 50 16	5 38 51 15	5 45 52 14	5 53 53 12	6 0 54 11	6 8 55 10	6 15	59	59	5	5				58	47	5
40	48 19	5 23 49 18	5 31 50 16	5 39 51 15	5 46 52 14	5 54 53 13	6 1 54 11	6 9 55 10	6 16	60	60	5	5				59	48	5
42	48 19	5 25 49 18	5 32 50 17	5 40 51 15	5 47 52 14	5 55 53 13	6 2 54 12	6 10 55 11	6 18	61	61	5	5				60	48	5
44	48 20	5 26 49 18	5 33 50 17	5 41 51 16	5 48 52 15	5 56 53 13	6 4 54 12	6 11 55 11	6 19	62	62	5	5				61	49	5
46	48 20	5 27 49 19	5 34 50 17	5 42 51 16	5 49 52 15	5 57 53 14	6 5 54 12	6 12 55 11	6 20	63	63	5	5				62	49	5
48	48 20	5 28 49 19	5 35 50 18	5 43 51 16	5 51 52 15	5 58 53 14	6 6 54 13	6 13 55 11	6 21	64	64	5	5				63	50	5
50	48 20	5 29 49 19	5 36 50 18	5 44 51 17	5 52 52 15	5 59 53 14	6 7 54 13	6 15 55 12	6 22	65	65	5	5				64	50	5
52	48 21	5 30 49 19	5 38 50 18	5 45 51 17	5 53 52 16	6 1 53 14	6 8 54 13	6 16 55 12	6 23	66	66	5	5				65	51	5
54	48 21	5 31 49 20	5 39 50 18	5 46 51 17	5 54 52 16	6 2 53 15	6 9 54 13	6 17 55 12	6 25	67	67	5	5				66	51	5
56	48 21	5 32 49 20	5 40 50 19	5 47 51 17	5 55 52 16	6 3 53 15	6 10 54 14	6 18 55 12	6 26	68	68	5	5				67	52	5
58	48 22	5 33 49 20	5 41 50 19	5 49 51 18	5 56 52 16	6 4 53 15	6 12 54 14	6 19 55 13	6 27	69	69	5	5				68	52	5

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (12° and 13°)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	Cor.	A
12°	Corr. +	A 60"	Corr. +	A 60"	Corr. +	A 60"	Corr. +	A 60"	Corr. +	A 60"	Corr. +	A 60"	Corr. +	A 60"	Corr. +	A 60"	"	Cor.	A
0'	48 22	5 34	49 21	5 42	50 19	5 50	51 18	5 57	52 17	6 5	53 15	6 13	54 14	6 20	55 13	6 28	1	1	0
2	48 22	5 35	49 21	5 43	50 20	5 51	51 18	5 59	52 17	6 6	53 16	6 14	54 14	6 22	55 13	6 29	2	2	0
4	48 23	5 36	49 21	5 44	50 20	5 52	51 19	6 0	52 17	6 7	53 16	6 15	54 15	6 23	55 13	6 31	3	3	0
6	48 23	5 38	49 22	5 45	50 20	5 53	51 19	6 1	52 18	6 9	53 16	6 16	54 15	6 24	55 14	6 32	4	4	0
8	48 23	5 39	49 22	5 46	50 21	5 54	51 19	6 2	52 18	6 10	53 17	6 17	54 15	6 25	55 14	6 33	5	5	0
10	48 24	5 40	49 22	5 47	50 21	5 55	51 20	6 3	52 18	6 11	53 17	6 19	54 16	6 26	55 14	6 34	6	6	0
12	48 24	5 41	49 23	5 49	50 21	5 56	51 20	6 4	52 19	6 12	53 17	6 20	54 16	6 28	55 15	6 35	7	7	0
14	48 25	5 42	49 23	5 50	50 22	5 58	51 20	6 5	52 19	6 13	53 18	6 21	54 16	6 29	55 15	6 37	8	8	0
16	48 25	5 43	49 23	5 51	50 22	5 59	51 21	6 6	52 19	6 14	53 18	6 22	54 16	6 30	55 15	6 38	9	9	0
18	48 25	5 44	49 24	5 52	50 22	6 0	51 21	6 8	52 19	6 15	53 18	6 23	54 17	6 31	55 16	6 39	10	10	0
20	48 25	5 45	49 24	5 53	50 22	6 1	51 21	6 9	52 20	6 17	53 18	6 24	54 17	6 32	55 16	6 40	11	11	0
22	48 25	5 46	49 24	5 54	50 23	6 2	51 21	6 10	52 20	6 18	53 19	6 26	54 17	6 34	55 16	6 41	12	12	0
24	48 26	5 47	49 24	5 55	50 23	6 3	51 22	6 11	52 20	6 19	53 19	6 27	54 18	6 35	55 16	6 43	13	13	0
26	48 26	5 48	49 25	5 56	50 23	6 4	51 22	6 12	52 21	6 20	53 19	6 28	54 18	6 36	55 16	6 44	14	14	0
28	48 26	5 49	49 25	5 57	50 24	6 5	51 22	6 13	52 21	6 21	53 19	6 29	54 18	6 37	55 17	6 45	15	15	0
30	48 27	5 50	49 25	5 58	50 24	6 6	51 22	6 14	52 21	6 22	53 20	6 30	54 18	6 38	55 17	6 46	16	16	0
32	48 27	5 51	49 26	5 59	50 24	6 7	51 23	6 15	52 21	6 23	53 20	6 31	54 19	6 39	55 17	6 47	17	17	0
34	48 27	5 52	49 26	6 0	50 24	6 8	51 23	6 16	52 22	6 25	53 20	6 33	54 19	6 41	55 17	6 49	18	18	0
36	48 28	5 53	49 26	6 1	50 25	6 10	51 23	6 18	52 22	6 26	53 20	6 34	54 19	6 42	55 18	6 50	19	19	0
38	48 28	5 54	49 26	6 3	50 25	6 11	51 24	6 19	52 22	6 27	53 21	6 35	54 19	6 43	55 18	6 51	20	20	0
40	48 28	5 55	49 27	6 4	50 25	6 12	51 24	6 20	52 22	6 28	53 21	6 36	54 19	6 44	55 18	6 52	21	21	0
42	48 28	5 57	49 27	6 5	50 25	6 13	51 24	6 21	52 23	6 29	53 21	6 37	54 20	6 45	55 18	6 53	22	22	0
44	48 29	5 58	49 27	6 6	50 26	6 14	51 24	6 22	52 23	6 30	53 21	6 38	54 20	6 46	55 18	6 55	23	23	0
46	48 29	5 59	49 27	6 7	50 26	6 15	51 24	6 23	52 23	6 31	53 21	6 39	54 20	6 48	55 19	6 56	24	24	0
48	48 29	6 0	49 28	6 8	50 26	6 16	51 25	6 24	52 23	6 32	53 22	6 41	54 20	6 49	55 19	6 57	25	25	0
50	48 29	6 1	49 28	6 9	50 26	6 17	51 25	6 25	52 23	6 34	53 22	6 42	54 20	6 50	55 19	6 58	26	26	0
52	48 29	6 2	49 28	6 10	50 26	6 18	51 25	6 27	52 23	6 35	53 22	6 43	54 21	6 51	55 19	6 59	27	27	0
54	48 30	6 3	49 28	6 11	50 27	6 19	51 25	6 28	52 24	6 36	53 22	6 44	54 21	6 52	55 19	7 0	28	28	0
56	48 30	6 4	49 28	6 12	50 27	6 20	51 25	6 29	52 24	6 37	53 22	6 45	54 21	6 54	55 19	7 1	29	29	0
58	48 30	6 5	49 29	6 13	50 27	6 22	51 26	6 30	52 24	6 38	53 23	6 46	54 21	6 55	55 20	7 2	30	30	0
13°																	3	3	0
0'	48 30	6 6	49 29	6 14	50 27	6 23	51 26	6 31	52 24	6 39	53 23	6 48	54 21	6 56	55 20	7 4	41	41	0
2	48 30	6 7	49 29	6 15	50 27	6 24	51 26	6 32	52 24	6 40	53 23	6 49	54 21	6 57	55 20	7 5	42	42	0
4	48 31	6 8	49 29	6 17	50 28	6 25	51 26	6 33	52 24	6 42	53 23	6 50	54 21	6 58	55 20	7 7	43	43	0
6	48 31	6 9	49 29	6 18	50 28	6 26	51 26	6 34	52 25	6 43	53 23	6 51	54 22	6 59	55 20	7 8	44	44	0
8	48 31	6 10	49 29	6 19	50 28	6 27	51 26	6 35	52 25	6 44	53 23	6 52	54 22	7 0	55 20	7 9	45	45	0
10	48 31	6 11	49 30	6 20	50 28	6 28	51 26	6 37	52 25	6 45	53 23	6 53	54 22	7 1	55 20	7 10	46	46	0
12	48 31	6 12	49 30	6 21	50 28	6 29	51 27	6 38	52 25	6 46	53 24	6 55	54 22	7 2	55 20	7 11	47	47	0
14	48 32	6 14	49 30	6 22	50 28	6 30	51 27	6 39	52 25	6 47	53 24	6 56	54 22	7 3	55 21	7 13	48	48	0
16	48 32	6 15	49 30	6 23	50 29	6 31	51 27	6 40	52 25	6 48	53 24	6 57	54 22	7 4	55 21	7 14	49	49	0
18	48 32	6 16	49 30	6 24	50 29	6 33	51 27	6 41	52 26	6 50	53 24	6 58	54 22	7 5	55 21	7 15	50	50	0
20	48 32	6 17	49 30	6 25	50 29	6 34	51 27	6 42	52 26	6 51	53 24	6 59	54 23	7 6	55 21	7 16	51	51	0
22	48 32	6 18	49 31	6 26	50 29	6 35	51 27	6 43	52 26	6 52	53 24	7 0	54 23	7 7	55 21	7 17	52	52	0
24	48 32	6 19	49 31	6 27	50 29	6 36	51 28	6 44	52 26	6 53	53 24	7 1	54 23	7 10	55 21	7 19	53	53	0
26	48 32	6 20	49 31	6 28	50 29	6 37	51 28	6 46	52 26	6 54	53 24	7 13	54 23	7 11	55 21	7 20	54	54	0
28	48 33	6 21	49 31	6 29	50 29	6 38	51 28	6 47	52 26	6 55	53 25	7 14	54 23	7 12	55 21	7 21	55	55	0
30	48 33	6 22	49 31	6 31	50 29	6 39	51 28	6 48	52 26	6 56	53 25	7 15	54 23	7 13	55 21	7 22	56	56	0
32	48 33	6 23	49 31	6 32	50 29	6 40	51 28	6 49	52 26	6 57	53 25	7 16	54 23	7 14	55 22	7 23	57	57	0
34	48 33	6 24	49 31	6 33	50 30	6 41	51 28	6 50	52 26	6 59	53 25	7 17	54 23	7 15	55 22	7 25	58	58	0
36	48 33	6 25	49 31	6 34	50 30	6 42	51 28	6 51	52 27	7 0	53 25	7 18	54 23	7 16	55 22	7 26	59	59	0
38	48 33	6 26	49 32	6 35	50 30	6 44	51 28	6 52	52 27	7 1	53 25	7 19	54 23	7 17	55 22	7 27	60	60	0
40	48 33	6 27	49 32	6 36	50 30	6 45	51 28	6 53	52 27	7 2	53 25	7 20	54 23	7 18	55 22	7 28	61	61	0
42	48 34	6 28	49 32	6 37	50 30	6 46	51 29	6 54	52 27	7 3	53 25	7 21	54 24	7 19	55 22	7 29	62	62	0
44	48 34	6 29	49 32	6 38	50 30	6 47	51 29	6 56	52 27	7 4	53 25	7 22	54 24	7 20	55 22	7 30	63	63	0
46	48 34	6 30	49 32	6 39	50 30	6 48	51 29	6 57	52 27	7 5	53 25	7 23	54 24	7 21	55 22	7 31	64	64	0
48	48 34	6 31	49 32	6 40	50 31	6 49	51 29	6 58	52 27	7 6	53 25	7 24	54 24	7 22	55 22	7 32	65	65	0
50	48 34	6 32	49 32	6 41	50 31	6 50	51 29	6 59	52 27	7 7	53 25	7 25	54 24	7 23	55 22	7 33	66	66	0
52	48 34	6 34	49 32	6 42	50 31	6 51	51 29	7 0	52 27	7 9	53 26	7 26	54 24	7 24	55 22	7 35	67	67	0
54	48 34	6 35	49 33	6 43	50 31	6 52	51 29	7 1	52 27	7 10	53 26	7 27	54 24	7 25	55 22	7 36	68	68	0
56	48 34	6 36	49 33	6 45	50 31	6 53	51 29	7 2	52 27	7 11	53 26	7 28	54 24	7 26	55 22	7 37	69	69	0
58	48 35	6 37	49 33	6 46	50 31	6 54	51 29	7 3	52 28	7 12	53 26	7 29	54 24	7 27	55 22	7 39	70	70	0

(14° and 15°) 'The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																		Seconds of H. P.			
	54'		55'		56'		57'		58'		59'		60'		61'		"					
	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	"	"	"			
14°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	Corr.	A 60°	1	2	3	
0'	48 35	6 38	49 33	6 47	50 31	6 56	51 29	7 4	52 28	7 13	53 26	7 22	54 24	7 31	55 22	7 40	56 20	7 49	1	2	3	
2	48 35	6 39	49 33	6 48	50 31	6 57	51 29	7 6	52 28	7 14	53 26	7 23	54 24	7 32	55 22	7 41	56 20	7 50	4	5	6	
4	48 35	6 40	49 33	6 49	50 31	6 58	51 30	7 7	52 28	7 16	53 26	7 24	54 24	7 33	55 22	7 42	56 20	7 51	5	6	7	
6	48 35	6 41	49 33	6 50	50 31	6 59	51 30	7 8	52 28	7 17	53 26	7 26	54 24	7 35	55 22	7 44	56 20	7 53	6	7	8	
8	48 35	6 42	49 33	6 51	50 32	7 0	51 30	7 9	52 28	7 18	53 26	7 27	54 24	7 36	55 22	7 45	56 20	7 54	7	8	9	
10	48 35	6 43	49 33	6 52	50 32	7 1	51 30	7 10	52 28	7 19	53 26	7 28	54 24	7 37	55 22	7 46	56 20	7 55	8	9	10	
12	48 35	6 44	49 33	6 53	50 32	7 2	51 30	7 11	52 28	7 20	53 26	7 29	54 24	7 38	55 22	7 47	56 20	7 56	10	11	12	
14	48 35	6 45	49 34	6 54	50 32	7 3	51 30	7 12	52 28	7 21	53 26	7 30	54 24	7 39	55 22	7 48	56 20	7 57	11	12	13	
16	48 35	6 46	49 34	6 55	50 32	7 4	51 30	7 13	52 28	7 22	53 26	7 31	54 24	7 40	55 22	7 49	56 20	7 58	12	13	14	
18	48 35	6 47	49 34	6 56	50 32	7 5	51 30	7 14	52 28	7 23	53 26	7 32	54 24	7 41	55 22	7 50	56 20	7 59	13	14	15	
20	48 36	6 48	49 34	6 57	50 32	7 6	51 30	7 15	52 28	7 24	53 26	7 33	54 24	7 42	55 22	7 51	56 20	7 60	14	15	16	
22	48 36	6 49	49 34	6 58	50 32	7 7	51 30	7 16	52 28	7 25	53 26	7 34	54 24	7 43	55 22	7 52	56 20	7 61	15	16	17	
24	48 36	6 50	49 34	7 0	50 32	7 8	51 30	7 17	52 28	7 26	53 26	7 35	54 24	7 44	55 22	7 53	56 20	7 62	16	17	18	
26	48 36	6 51	49 34	7 1	50 32	7 9	51 30	7 18	52 28	7 27	53 26	7 36	54 24	7 45	55 22	7 54	56 20	7 63	17	18	19	
28	48 36	6 53	49 34	7 2	50 32	7 10	51 30	7 19	52 28	7 28	53 26	7 37	54 24	7 46	55 22	7 55	56 20	7 64	18	19	20	
30	48 36	6 54	49 34	7 3	50 32	7 11	51 30	7 20	52 28	7 29	53 26	7 38	54 24	7 47	55 22	7 56	56 20	7 65	19	20	21	
32	48 36	6 55	49 34	7 4	50 32	7 12	51 30	7 21	52 28	7 30	53 26	7 39	54 24	7 48	55 22	7 57	56 20	7 66	20	21	22	
34	48 36	6 56	49 34	7 5	50 32	7 13	51 30	7 22	52 28	7 31	53 26	7 40	54 24	7 49	55 22	7 58	56 20	7 67	21	22	23	
36	48 36	6 57	49 34	7 6	50 32	7 14	51 30	7 23	52 28	7 32	53 26	7 41	54 24	7 50	55 22	7 59	56 20	7 68	22	23	24	
38	48 36	6 58	49 34	7 7	50 32	7 15	51 30	7 24	52 28	7 33	53 26	7 42	54 24	7 51	55 22	8 0	56 20	7 69	23	24	25	
40	48 36	6 59	49 34	7 8	50 32	7 16	51 30	7 25	52 28	7 34	53 26	7 43	54 24	7 52	55 22	8 1	56 20	7 70	24	25	26	
42	48 36	7 0	49 34	7 9	50 32	7 17	51 30	7 26	52 28	7 35	53 26	7 44	54 24	7 53	55 22	8 2	56 20	7 71	25	26	27	
44	48 36	7 1	49 34	7 10	50 32	7 18	51 30	7 27	52 28	7 36	53 26	7 45	54 24	7 54	55 22	8 3	56 20	7 72	26	27	28	
46	48 36	7 2	49 34	7 11	50 32	7 19	51 30	7 28	52 28	7 37	53 26	7 46	54 24	7 55	55 22	8 4	56 20	7 73	27	28	29	
48	48 36	7 3	49 34	7 12	50 32	7 20	51 30	7 29	52 28	7 38	53 26	7 47	54 24	7 56	55 22	8 5	56 20	7 74	28	29	30	
50	48 36	7 4	49 34	7 13	50 32	7 21	51 30	7 30	52 28	7 39	53 26	7 48	54 24	7 57	55 22	8 6	56 20	7 75	29	30	31	
52	48 36	7 5	49 34	7 14	50 32	7 22	51 30	7 31	52 28	7 40	53 26	7 49	54 24	7 58	55 22	8 7	56 20	7 76	30	31	32	
54	48 36	7 6	49 34	7 15	50 32	7 23	51 30	7 32	52 28	7 41	53 26	7 50	54 24	7 59	55 22	8 8	56 20	7 77	31	32	33	
56	48 36	7 7	49 34	7 16	50 32	7 24	51 30	7 33	52 28	7 42	53 26	7 51	54 24	8 0	55 22	8 9	56 20	7 78	32	33	34	
58	48 36	7 8	49 34	7 17	50 32	7 25	51 30	7 34	52 28	7 43	53 26	7 52	54 24	8 1	55 22	8 10	56 20	7 79	33	34	35	
15°	54'	55'	56'	57'	58'	59'	60'	61'	40	39	38	37	36	35	34	33	32	31	30	29	28	27
0'	48 36	7 9	49 34	7 19	50 32	7 28	51 30	7 38	52 28	7 47	53 26	7 57	54 24	8 6	55 22	8 16	56 20	7 80	34	35	36	
2	48 36	7 10	49 34	7 20	50 32	7 29	51 30	7 39	52 28	7 48	53 26	7 58	54 24	8 7	55 22	8 17	56 20	7 81	35	36	37	
4	48 36	7 11	49 34	7 21	50 32	7 30	51 30	7 40	52 28	7 49	53 26	7 59	54 24	8 8	55 22	8 18	56 20	7 82	36	37	38	
6	48 36	7 13	49 34	7 22	50 32	7 32	51 30	7 41	52 28	7 51	53 26	8 0	54 24	8 10	55 22	8 19	56 20	7 83	37	38	39	
8	48 36	7 14	49 34	7 23	50 32	7 33	51 30	7 42	52 28	7 52	53 26	8 1	54 24	8 11	55 22	8 20	56 20	7 84	38	39	40	
10	48 36	7 15	49 34	7 24	50 32	7 34	51 30	7 43	52 28	7 53	53 26	8 2	54 24	8 12	55 22	8 21	56 20	7 85	39	40	41	
12	48 36	7 16	49 34	7 25	50 32	7 35	51 30	7 44	52 28	7 54	53 26	8 3	54 23	8 13	55 22	8 22	56 20	7 86	40	41	42	
14	48 36	7 17	49 34	7 26	50 32	7 36	51 30	7 45	52 28	7 55	53 26	8 4	54 23	8 14	55 22	8 23	56 20	7 87	41	42	43	
16	48 36	7 18	49 34	7 27	50 32	7 37	51 30	7 47	52 28	7 56	53 25	8 5	54 23	8 15	55 21	8 25	51 48	7 88	42	43	44	
18	48 36	7 19	49 34	7 28	50 32	7 38	51 30	7 48	52 27	7 57	53 25	8 7	54 23	8 17	55 21	8 26	52 50	7 89	43	44	45	
20	48 36	7 20	49 34	7 29	50 32	7 39	51 30	7 49	52 27	7 58	53 25	8 8	54 23	8 18	55 21	8 27	54 52	7 90	44	45	46	
22	48 36	7 21	49 34	7 31	50 32	7 40	51 30	7 50	52 27	8 0	53 25	8 9	54 23	8 19	55 21	8 29	55 53	7 91	45	46	47	
24	48 36	7 22	49 34	7 32	50 32	7 41	51 30	7 51	52 27	8 1	53 25	8 10	54 23	8 20	55 21	8 30	56 54	7 92	46	47	48	
26	48 36	7 23	49 34	7 33	50 32	7 42	51 29	7 52	52 27	8 2	53 25	8 11	54 23	8 21	55 21	8 31	57 55	7 93	47	48	49	
28	48 36	7 24	49 34	7 34	50 31	7 43	51 29	7 53	52 27	8 3	53 25	8 13	54 23	8 22	55 21	8 32	58 56	7 94	48	49	50	
30	48 36	7 25	49 33	7 35	50 31	7 44	51 29	7 54	52 27	8 4	53 25	8 14	54 23	8 23	55 21	8 33	59 57	7 95	49	50	51	
32	48 36	7 26	49 33	7 36	50 31	7 46	51 29	7 55	52 27	8 5	53 25	8 15	54 23	8 25	55 20	8 34	60 58	7 96	50	51	52	
34	48 36	7 27	49 33	7 37	50 31	7 47	51 29	7 56	52 27	8 6	53 25	8 16	54 22	8 26	55 20	8 36	61 59	7 97	51	52	53	
36	48 36	7 28	49 33	7 38	50 31	7 48	51 29	7 58	52 27	8 7	53 24	8 17	54 22	8 27	55 20	8 37	62 59	7 98	52	53	54	
38	48 36	7 29	49 33	7 39	50 31	7 49	51 29	7 59	52 27	8 8	53 24	8 18	54 22	8 28	55 20	8 38	63 59	7 99	53	54	55	
40	48 36	7 30	49 33	7 40	50 31	7 50	51 29	8 0	52 27	8 9	53 24	8 19	54 22	8 29	55 20	8 39	64 59	7 100	54	55	56	
42	48 36	7 31	49 33	7 41	50 31	7 51	51 29	8 1	52 27	8 11	53 24	8 21	54 22	8 30	55 20	8 40	65 59	7 101	55	56	57	
44	48 36	7 32	49 33	7 42	50 31	7 52	51 29	8 2	52 27	8 12	53 24	8 22	54 22	8 32	55 20	8 41	66 59	7 102	56	57	58	
46	48 36	7 33	49 33	7 43	50 31	7 53	51 29	8 3	52 27	8 13	53 24	8 23	54 22	8 33	55 20	8 43	67 59	7 103	57	58	59	
48	48 36	7 34	49 33	7 44	50 31	7 54	51 29	8 4	52 27	8 14	53 24	8 24	54 22	8 34	55 20	8 44	68 59	7 104	58	59	60	
50	48 36	7 35	49 33	7 45	50 31	7 55	51 29	8 5	52 27	8 15	53 24	8 25	54 22	8 35	55 19	8 45	69 59	7 105	59	60	61	
52	48 36	7 37	49 33	7 46	50 31	7 56	51 29	8 6	52 27	8 16	53 24	8 26	54 22	8 36	55 19	8 46	70 59	7 106	60	61	62	
54	48 36	7 38	49 33	7 48	50 31	7 57	51 29	8 7	52 26	8 17	53 24	8 27	54 22	8 37	55 19	8 47	71 59	7 107	61	62	63	
56	48 36	7 39	49 33	7 49	50 31	7 59	51 29															

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (16° and 17°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									Corr.	A
16°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	1	0
0'	48 36	7 41	49 33	7 51	50 31	8 1	51 28	8 11	52 26	8 21	53 23	8 31	54 21	8 41	55 19	8 50	2	0
2	48 36	7 42	49 33	7 52	50 31	8 2	51 28	8 12	52 26	8 22	53 23	8 32	54 21	8 42	55 18	8 52	3	1
4	48 35	7 43	49 33	7 53	50 30	8 3	51 28	8 13	52 26	8 23	53 23	8 33	54 21	8 43	55 18	8 53	4	1
6	48 35	7 44	49 33	7 54	50 30	8 4	51 28	8 14	52 25	8 24	53 23	8 34	54 20	8 44	55 18	8 54	5	1
8	48 35	7 45	49 32	7 55	50 30	8 5	51 28	8 15	52 25	8 25	53 23	8 35	54 20	8 45	55 18	8 55	6	1
10	48 35	7 46	49 32	7 56	50 30	8 6	51 27	8 16	52 25	8 26	53 23	8 36	54 20	8 47	55 18	8 57	7	1
12	48 34	7 47	49 32	7 57	50 30	8 7	51 27	8 17	52 25	8 27	53 22	8 38	54 20	8 48	55 18	8 58	8	1
14	48 34	7 48	49 32	7 58	50 29	8 8	51 27	8 18	52 25	8 29	53 22	8 39	54 20	8 49	55 17	8 59	9	1
16	48 34	7 49	49 32	7 59	50 29	8 9	51 27	8 20	52 24	8 30	53 22	8 40	54 20	8 50	55 17	9 0	10	2
18	48 34	7 50	49 31	8 0	50 29	8 10	51 27	8 21	52 24	8 31	53 22	8 41	54 19	8 51	55 17	9 1	11	2
20	48 33	7 51	49 31	8 1	50 29	8 11	51 26	8 22	52 24	8 32	53 21	8 42	54 19	8 52	55 17	9 2	12	2
22	48 33	7 52	49 31	8 2	50 29	8 13	51 26	8 23	52 24	8 33	53 21	8 43	54 19	8 54	55 17	9 3	13	2
24	48 33	7 53	49 31	8 3	50 28	8 14	51 26	8 24	52 24	8 34	53 21	8 45	54 19	8 55	55 16	9 4	14	3
26	48 33	7 54	49 31	8 4	50 28	8 15	51 26	8 25	52 23	8 35	53 21	8 46	54 19	8 56	55 16	9 5	15	3
28	48 33	7 55	49 31	8 6	50 28	8 16	51 26	8 26	52 23	8 36	53 21	8 47	54 18	8 57	55 16	9 7	16	3
30	48 33	7 56	49 30	8 7	50 28	8 17	51 26	8 27	52 23	8 37	53 21	8 48	54 18	8 58	55 16	9 8	17	3
32	48 33	7 57	49 30	8 8	50 28	8 18	51 25	8 28	52 23	8 39	53 21	8 49	54 18	8 59	55 16	9 10	18	3
34	48 33	7 58	49 30	8 9	50 28	8 19	51 25	8 29	52 23	8 40	53 20	8 50	54 18	9 0	55 15	9 11	19	3
36	48 33	7 59	49 30	8 10	50 28	8 20	51 25	8 31	52 23	8 41	53 20	8 51	54 18	9 1	55 15	9 12	20	3
38	48 32	8 0	49 30	8 11	50 27	8 21	51 25	8 32	52 22	8 42	53 20	8 52	54 17	9 2	55 15	9 13	21	3
40	48 32	8 1	49 30	8 12	50 27	8 22	51 25	8 33	52 22	8 43	53 20	8 54	54 17	9 3	55 15	9 14	22	3
42	48 32	8 3	49 30	8 13	50 27	8 23	51 25	8 34	52 22	8 44	53 20	8 55	54 17	9 4	55 15	9 15	23	3
44	48 32	8 4	49 29	8 14	50 27	8 25	51 24	8 35	52 22	8 45	53 19	8 56	54 17	9 5	55 14	9 16	24	3
46	48 32	8 5	49 29	8 15	50 27	8 26	51 24	8 36	52 22	8 47	53 19	8 57	54 17	9 6	55 14	9 17	25	3
48	48 32	8 6	49 29	8 16	50 27	8 27	51 24	8 37	52 21	8 48	53 19	8 58	54 16	9 7	55 14	9 18	26	3
50	48 32	8 7	49 29	8 17	50 26	8 28	51 24	8 38	52 21	8 49	53 19	8 59	54 16	9 8	55 14	9 19	27	3
52	48 31	8 8	49 29	8 18	50 26	8 29	51 24	8 39	52 21	8 50	53 19	9 0	54 16	9 11	55 13	9 20	28	3
54	48 31	8 9	49 29	8 19	50 26	8 30	51 24	8 40	52 21	8 51	53 18	9 1	54 16	9 12	55 13	9 21	29	3
56	48 31	8 10	49 29	8 20	50 26	8 31	51 23	8 42	52 21	8 52	53 18	9 2	54 16	9 13	55 13	9 22	30	3
58	48 31	8 11	49 28	8 21	50 26	8 32	51 23	8 43	52 20	8 53	53 18	9 3	54 15	9 14	55 13	9 23	31	3
17°	54'	55'	56'	57'	58'	59'	60'	61'									32	3
0'	48 31	8 12	49 28	8 22	50 26	8 33	51 23	8 44	52 20	8 54	53 18	9 5	54 15	9 16	55 12	9 26	32	3
2	48 31	8 13	49 28	8 24	50 25	8 34	51 23	8 45	52 20	8 56	53 17	9 6	54 15	9 17	55 12	9 27	33	3
4	48 30	8 14	49 28	8 25	50 25	8 35	51 23	8 46	52 20	8 57	53 17	9 7	54 15	9 18	55 12	9 28	34	3
6	48 30	8 15	49 28	8 26	50 25	8 36	51 22	8 47	52 20	8 58	53 17	9 8	54 14	9 19	55 12	9 30	35	3
8	48 30	8 16	49 27	8 27	50 25	8 37	51 22	8 48	52 19	8 59	53 17	9 10	54 14	9 20	55 11	9 31	36	3
10	48 30	8 17	49 27	8 28	50 25	8 38	51 22	8 49	52 19	9 0	53 17	9 11	54 14	9 21	55 11	9 32	37	3
12	48 30	8 18	49 27	8 29	50 24	8 40	51 22	8 50	52 19	9 1	53 16	9 12	54 14	9 22	55 11	9 33	38	3
14	48 29	8 19	49 27	8 30	50 24	8 41	51 21	8 51	52 19	9 2	53 16	9 13	54 13	9 24	55 11	9 34	39	3
16	48 29	8 20	49 27	8 31	50 24	8 42	51 21	8 53	52 19	9 3	53 16	9 14	54 13	9 25	55 10	9 36	40	3
18	48 29	8 21	49 26	8 32	50 24	8 43	51 21	8 54	52 18	9 4	53 16	9 15	54 13	9 26	55 10	9 37	41	3
20	48 29	8 22	49 26	8 33	50 23	8 44	51 21	8 55	52 18	9 5	53 15	9 16	54 13	9 27	55 10	9 38	42	3
22	48 29	8 23	49 26	8 34	50 23	8 45	51 21	8 56	52 18	9 7	53 15	9 17	54 12	9 28	55 10	9 39	43	3
24	48 28	8 24	49 26	8 35	50 23	8 46	51 20	8 57	52 18	9 8	53 15	9 19	54 12	9 29	55 9	9 40	44	3
26	48 28	8 25	49 26	8 36	50 23	8 47	51 20	8 58	52 17	9 9	53 15	9 20	54 12	9 31	55 9	9 41	45	3
28	48 28	8 26	49 25	8 37	50 23	8 48	51 20	8 59	52 17	9 10	53 14	9 21	54 12	9 32	55 9	9 43	46	3
30	48 28	8 27	49 25	8 38	50 22	8 49	51 20	9 0	52 17	9 11	53 14	9 22	54 11	9 33	55 9	9 44	47	3
32	48 28	8 28	49 25	8 39	50 22	8 50	51 19	9 1	52 17	9 12	53 14	9 23	54 11	9 34	55 8	9 45	48	3
34	48 27	8 30	49 25	8 40	50 22	8 51	51 19	9 2	52 16	9 13	53 14	9 24	54 11	9 35	55 8	9 46	49	3
36	48 27	8 31	49 25	8 41	50 22	8 52	51 19	9 3	52 16	9 14	53 13	9 25	54 11	9 36	55 8	9 47	50	3
38	48 27	8 32	49 24	8 43	50 22	8 54	51 19	9 5	52 16	9 15	53 13	9 26	54 10	9 37	55 8	9 48	51	3
40	48 27	8 33	49 24	8 44	50 21	8 55	51 18	9 6	52 16	9 17	53 13	9 28	54 10	9 39	55 7	9 50	52	3
42	48 27	8 34	49 24	8 45	50 21	8 56	51 18	9 7	52 15	9 18	53 13	9 29	54 10	9 40	55 7	9 51	53	3
44	48 26	8 35	49 24	8 46	50 21	8 57	51 18	9 8	52 15	9 19	53 12	9 30	54 9	9 41	55 7	9 52	54	3
46	48 26	8 36	49 23	8 47	50 21	8 58	51 18	9 9	52 15	9 20	53 12	9 31	54 9	9 42	55 6	9 53	55	3
48	48 26	8 37	49 23	8 48	50 20	8 59	51 17	9 10	52 15	9 21	53 12	9 32	54 9	9 43	55 6	9 54	56	3
50	48 26	8 38	49 23	8 49	50 20	9 0	51 17	9 11	52 14	9 22	53 11	9 33	54 8	9 44	55 6	9 55	57	3
52	48 26	8 39	49 23	8 50	50 20	9 1	51 17	9 12	52 14	9 23	53 11	9 34	54 8	9 45	55 6	9 57	58	3
54	48 25	8 40	49 22	8 51	50 20	9 2	51 17	9 13	52 14	9 24	53 11	9 35	54 8	9 47	55 5	9 59	59	3
56	48 25	8 41	49 22	8 52	50 19	9 3	51 16	9 14	52 13	9 25	53 11	9 37	54 8	9 48	55 5	9 59	60	3
58	48 25	8 42	49 22	8 53	50 19	9 4	51 16	9 15	52 13	9 26	53 10	9 38	54 7	9 49	55 4	9 59	61	3

(18° and 19°) The Correction of the Moon's Altitude, and the Aux. Angle A

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.			
	54'		55'		56'		57'		58'		59'		60'		61'		"	A		
18°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	A		
0'	48 25	8 43	49 22	8 54	50 19	9 5	51 16	9 16	52 13	9 28	53 10	9 39	54 7	9 50	55 4	10 1	1	0		
2	48 24	8 44	49 22	8 55	50 19	9 6	51 16	9 18	52 13	9 29	53 10	9 40	54 7	9 51	55 4	10 2	2	0		
4	48 24	8 45	49 21	8 56	50 18	9 7	51 15	9 19	52 12	9 30	53 9	9 41	54 6	9 52	55 3	10 4	3	0		
6	48 24	8 46	49 21	8 57	50 18	9 8	51 15	9 20	52 12	9 31	53 9	9 42	54 6	9 53	55 3	10 5	6	1		
8	48 24	8 47	49 21	8 58	50 18	9 10	51 15	9 21	52 12	9 32	53 9	9 43	54 6	9 55	55 3	10 6	7	1		
10	48 23	8 48	49 20	8 59	50 17	9 11	51 14	9 22	52 11	9 33	53 8	9 44	54 5	9 56	55 3	10 7	8	2		
12	48 23	8 49	49 20	9 0	50 17	9 12	51 14	9 23	52 11	9 34	53 8	9 46	54 5	9 57	55 2	10 8	9	2		
14	48 23	8 50	49 20	9 1	50 17	9 13	51 14	9 24	52 11	9 35	53 8	9 47	54 5	9 58	55 2	10 9	10	2		
16	48 23	8 51	49 20	9 2	50 17	9 14	51 14	9 25	52 11	9 36	53 8	9 48	54 5	9 59	55 2	10 10	11	2		
18	48 22	8 52	49 19	9 4	50 16	9 15	51 13	9 26	52 10	9 38	53 7	9 49	54 4	10 0	55 1	10 12	12	3		
20	48 22	8 53	49 19	9 5	50 16	9 16	51 13	9 27	52 10	9 39	53 7	9 50	54 4	10 1	55 1	10 13	13	3		
22	48 22	8 54	49 19	9 6	50 16	9 17	51 13	9 28	52 10	9 40	53 7	9 51	54 4	10 3	55 1	10 14	14	3		
24	48 22	8 55	49 19	9 7	50 15	9 18	51 12	9 29	52 9	9 41	53 6	9 52	54 3	10 4	55 0	10 15	15	3		
26	48 21	8 56	49 18	9 8	50 15	9 19	51 12	9 31	52 9	9 42	53 6	9 53	54 3	10 5	55 0	10 16	16	3		
28	48 21	8 57	49 18	9 9	50 15	9 20	51 12	9 32	52 9	9 43	53 6	9 55	54 3	10 6	55 0	10 17	17	3		
30	48 21	8 58	49 18	9 10	50 15	9 21	51 12	9 33	52 8	9 44	53 5	9 56	54 2	10 7	54 59	10 19	18	4		
32	48 20	8 59	49 17	9 11	50 14	9 22	51 11	9 34	52 8	9 45	53 5	9 57	54 2	10 8	54 59	10 20	19	4		
34	48 20	9 0	49 17	9 12	50 14	9 23	51 11	9 35	52 8	9 46	53 5	9 58	54 2	10 9	54 58	10 21	20	4		
36	48 20	9 1	49 17	9 13	50 14	9 24	51 11	9 36	52 7	9 47	53 4	9 59	54 1	10 11	54 58	10 22	21	4		
38	48 20	9 2	49 17	9 14	50 13	9 26	51 10	9 37	52 7	9 49	53 4	10 0	54 1	10 12	54 58	10 23	22	5		
40	48 19	9 3	49 16	9 15	50 13	9 27	51 10	9 38	52 7	9 50	53 4	10 1	54 0	10 13	54 57	10 24	23	5		
42	48 19	9 5	49 16	9 16	50 13	9 28	51 10	9 39	52 6	9 51	53 3	10 2	54 0	10 14	54 57	10 26	24	6		
44	48 19	9 6	49 16	9 17	50 13	9 29	51 9	9 40	52 6	9 52	53 3	10 3	54 0	10 15	54 57	10 27	25	6		
46	48 19	9 7	49 15	9 18	50 12	9 30	51 9	9 41	52 6	9 53	53 3	10 4	53 59	10 16	54 56	10 28	26	6		
48	48 18	9 8	49 15	9 19	50 12	9 31	51 9	9 43	52 6	9 54	53 2	10 6	53 59	10 17	54 56	10 29	27	6		
50	48 18	9 9	49 15	9 20	50 12	9 32	51 8	9 44	52 5	9 55	53 2	10 7	53 59	10 19	54 56	10 30	28	6		
52	48 18	9 10	49 15	9 21	50 11	9 33	51 8	9 45	52 5	9 56	53 2	10 8	53 58	10 20	54 55	10 31	29	6		
54	48 18	9 11	49 14	9 22	50 11	9 34	51 8	9 46	52 5	9 57	53 1	10 9	53 58	10 21	54 55	10 33	30	7		
56	48 17	9 12	49 14	9 23	50 11	9 35	51 7	9 47	52 4	9 58	53 1	10 10	53 58	10 22	54 55	10 34	31	7		
58	48 17	9 13	49 14	9 25	50 10	9 36	51 7	9 48	52 4	10 0	53 1	10 11	53 57	10 23	54 54	10 35	32	8		
19°	54'	55'	56'	57'	58'	59'	60'	61'												
0'	48 17	9 14	49 13	9 26	50 10	9 37	51 7	9 49	52 4	10 1	53 0	10 13	53 57	10 24	54 54	10 36	40	8		
2	48 16	9 15	49 13	9 27	50 10	9 38	51 7	9 50	52 3	10 2	53 0	10 14	53 57	10 25	54 53	10 37	41	8		
4	48 16	9 16	49 13	9 28	50 9	9 39	51 6	9 51	52 3	10 3	53 0	10 15	53 56	10 27	54 53	10 38	42	9		
6	48 16	9 17	49 12	9 29	50 9	9 40	51 6	9 52	52 3	10 4	52 59	10 16	53 56	10 28	54 53	10 40	43	9		
8	48 15	9 18	49 12	9 30	50 9	9 42	51 5	9 53	52 2	10 5	52 59	10 17	53 56	10 29	54 52	10 41	44	9		
10	48 15	9 19	49 12	9 31	50 8	9 43	51 5	9 54	52 2	10 6	52 58	10 18	53 55	10 30	54 52	10 42	45	9		
12	46 15	9 20	49 11	9 32	50 8	9 44	51 5	9 56	52 1	10 7	52 58	10 19	53 55	10 31	54 51	10 43	46	10		
14	48 14	9 21	49 11	9 33	50 8	9 45	51 4	9 57	52 1	10 8	52 58	10 20	53 54	10 32	54 51	10 44	47	10		
16	48 14	9 22	49 11	9 34	50 7	9 46	51 4	9 58	52 1	10 10	52 57	10 21	53 54	10 33	54 51	10 45	48	10		
18	48 14	9 23	49 10	9 35	50 7	9 47	51 4	9 59	52 0	10 11	52 57	10 23	53 54	10 35	54 50	10 46	49	10		
20	48 13	9 24	49 10	9 36	50 7	9 48	51 3	10 0	52 0	10 12	52 57	10 24	53 53	10 36	54 50	10 48	50	11		
22	48 13	9 25	49 10	9 37	50 6	9 49	51 3	10 1	52 0	10 13	52 56	10 25	53 53	10 37	54 49	10 49	51	11		
24	48 13	9 26	49 9	9 38	50 6	9 50	51 3	10 2	51 59	10 14	52 56	10 26	53 52	10 38	54 49	10 50	52	11		
26	48 12	9 27	49 9	9 39	50 6	9 51	51 2	10 3	51 59	10 15	52 55	10 27	53 52	10 39	54 49	10 51	53	11		
28	48 12	9 28	49 9	9 40	50 5	9 52	51 2	10 4	51 59	10 16	52 55	10 28	53 52	10 40	54 48	10 52	54	11		
30	48 12	9 29	49 8	9 41	50 5	9 53	51 1	10 5	51 58	10 17	52 55	10 29	53 51	10 41	54 48	10 53	55	11		
32	48 11	9 30	49 8	9 42	50 5	9 54	51 1	10 6	51 58	10 18	52 54	10 30	53 51	10 42	54 47	10 54	56	11		
34	48 11	9 31	49 8	9 43	50 4	9 55	51 1	10 7	51 57	10 19	52 54	10 31	53 50	10 44	54 47	10 56	57	11		
36	48 11	9 32	49 7	9 44	50 4	9 56	51 0	10 8	51 57	10 21	52 54	10 33	53 50	10 45	54 47	10 57	58	11		
38	48 11	9 33	49 7	9 45	50 4	9 57	51 0	10 10	51 57	10 22	52 53	10 34	53 50	10 46	54 46	10 58	59	11		
40	48 10	9 34	49 7	9 46	50 3	9 58	51 0	10 11	51 56	10 23	52 53	10 35	53 49	10 47	54 46	10 59	60	11		
42	48 10	9 35	49 6	9 47	50 3	10 0	50 59	10 12	51 56	10 24	52 52	10 36	53 49	10 48	54 45	11 0	61	11		
44	48 10	9 36	49 6	9 48	50 2	10 1	50 59	10 13	51 56	10 25	52 52	10 37	53 48	10 49	54 45	11 1	62	11		
46	48 9	9 37	49 6	9 49	50 2	10 2	50 59	10 14	51 55	10 26	52 52	10 38	53 48	10 50	54 45	11 2	63	11		
48	48 9	9 38	49 5	9 50	50 2	10 3	50 58	10 15	51 55	10 27	52 51	10 39	53 48	10 51	54 44	11 3	64	11		
50	48 8	9 39	49 5	9 51	50 1	10 4	50 58	10 16	51 54	10 28	52 51	10 40	53 47	10 53	54 44	11 4	65	11		
52	48 8	9 40	49 5	9 52	50 1	10 5	50 57	10 17	51 54	10 29	52 50	10 41	53 47	10 54	54 43	11 5	66	11		
54	48 8	9 41	49 4	9 53	50 1	10 6	50 57	10 18	51 54	10 30	52 50	10 42	53 46	10 55	54 43	11 6	67	11		
56	48 7	9 42	49 4	9 54	50 0	10 7	50 57	10 19	51 53	10 31	52 50	10 43	53 46	10 56	54 42	11 7	68	11		
58	48 7	9 43	49 4	9 55	50 0	10 8	50 56	10 20	51 53	10 32	52 49	10 45	53 46	10 57	54 42	11 8	69	11		

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (20° and 21°)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	"	A
20°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"	"
0'	48 7	9 44 49	3	9 57	50 0	10 9	50 56	10 21	51 52	10 34	52 49	10 46	53 45	10 58	54 42	11 11	1	1	0
2	48 6	9 45 49	3	9 58	49 59	10 10	50 56	10 22	51 52	10 35	52 48	10 47	53 45	11 05	54 41	11 12	2	3	1
4	48 6	9 46 49	2	9 59	49 59	10 11	50 55	10 24	51 52	10 36	52 48	10 48	53 44	11 15	54 41	11 13	3	4	1
6	48 6	9 47 49	2	10 0	49 58	10 12	50 55	10 25	51 51	10 37	52 47	10 49	53 44	11 25	54 40	11 14	4	5	1
8	48 5	9 48 49	2	10 1	49 58	10 13	50 54	10 26	51 51	10 38	52 47	10 50	53 43	11 35	54 40	11 15	5	6	1
10	48 5	9 49 49	1	10 2	49 58	10 14	50 54	10 27	51 50	10 39	52 47	10 52	53 43	11 45	54 39	11 16	6	7	1
12	48 5	9 51 49	1	10 3	49 57	10 15	50 54	10 28	51 50	10 40	52 46	10 53	53 42	11 55	54 39	11 18	7	8	2
14	48 4	9 52 49	0	10 4	49 57	10 16	50 53	10 29	51 49	10 41	52 46	10 54	53 42	12 05	54 38	11 19	8	9	2
16	48 4	9 53 49	0	10 5	49 56	10 17	50 53	10 30	51 49	10 42	52 45	10 55	53 42	12 15	54 38	11 20	9	10	2
18	48 3	9 54 49	0	10 6	49 56	10 18	50 52	10 31	51 49	10 44	52 45	10 56	53 41	12 25	54 37	11 21	10	11	3
20	48 3	9 55 48 59	10	7	49 56	10 20	50 52	10 32	51 48	10 45	52 44	10 57	53 41	12 35	54 37	11 22	11	12	3
22	48 3	9 56 48 59	10	8	49 55	10 21	50 51	10 33	51 48	10 46	52 44	10 58	53 40	12 45	54 37	11 23	12	13	3
24	48 2	9 57 48 58	10	9	49 55	10 22	50 51	10 34	51 47	10 47	52 44	10 59	53 40	12 55	54 36	11 24	13	14	3
26	48 2	9 58 48 58	10	10	49 54	10 23	50 51	10 35	51 47	10 48	52 43	11 05	53 39	13 05	54 36	11 26	14	15	4
28	48 1	9 59 48 58	10	11	49 54	10 24	50 50	10 36	51 46	10 49	52 43	11 25	53 39	13 15	54 35	11 27	15	16	4
30	48 1	10 0	48 57	10 12	49 54	10 25	50 50	10 37	51 46	10 50	52 42	11 35	53 38	13 25	54 35	11 28	16	17	5
32	48 1	10 1	48 57	10 13	49 53	10 26	50 50	10 39	51 46	10 51	52 42	11 45	53 38	13 35	54 34	11 29	17	18	5
34	48 0	10 2	48 56	10 14	49 53	10 27	50 49	10 40	51 45	10 52	52 41	11 55	53 37	13 45	54 34	11 30	18	19	5
36	48 0	10 3	48 56	10 15	49 52	10 28	50 48	10 41	51 45	10 53	52 41	12 05	53 37	13 55	54 33	11 31	19	20	5
38	47 59	10 4	48 56	10 16	49 52	10 29	50 48	10 42	51 44	10 54	52 40	12 15	53 37	14 05	54 33	11 32	20	21	6
40	47 59	10 5	48 55	10 17	49 51	10 30	50 48	10 43	51 44	10 55	52 40	12 25	53 36	14 15	54 32	11 34	21	22	6
42	47 59	10 6	48 55	10 18	49 51	10 31	50 47	10 44	51 43	10 57	52 40	12 35	53 36	14 25	54 32	11 35	22	23	6
44	47 58	10 7	48 54	10 19	49 51	10 32	50 47	10 45	51 43	10 58	52 39	12 45	53 35	14 35	54 31	11 36	23	24	7
46	47 58	10 8	48 54	10 21	49 50	10 33	50 46	10 46	51 42	10 59	52 39	12 55	53 35	14 45	54 31	11 37	24	25	7
48	47 58	10 9	48 54	10 22	49 50	10 34	50 46	10 47	51 42	11 05	52 38	13 05	53 34	14 55	54 30	11 38	25	26	7
50	47 57	10 10	48 53	10 23	49 49	10 35	50 45	10 48	51 42	11 15	52 38	13 15	53 34	15 05	54 30	11 39	26	27	7
52	47 57	10 11	48 53	10 24	49 49	10 36	50 45	10 49	51 41	11 25	52 37	13 25	53 33	15 15	54 29	11 40	27	28	8
54	47 56	10 12	48 52	10 25	49 49	10 37	50 45	10 50	51 41	11 35	52 37	13 35	53 33	15 25	54 29	11 42	28	29	8
56	47 56	10 13	48 52	10 26	49 48	10 38	50 44	10 51	51 40	11 45	52 36	13 45	53 32	15 35	54 28	11 43	29	30	8
58	47 56	10 14	48 52	10 27	49 48	10 40	50 44	10 52	51 40	11 55	52 36	13 55	53 32	15 45	54 28	11 44	30	31	8
21°	54'	55'	56'	57'	58'	59'	60'	61'	54'	55'	56'	57'	58'	59'	60'	61'	40	37	9
0'	47 55	10 15	48 51	10 28	49 47	10 41	50 43	10 53	51 39	11 65	52 35	11 19	53 31	11 32	54 27	11 45	41	38	9
2	47 55	10 16	48 51	10 29	49 47	10 42	50 43	10 55	51 39	11 75	52 35	11 20	53 31	11 33	54 27	11 46	42	39	9
4	47 54	10 17	48 50	10 30	49 46	10 43	50 42	10 56	51 38	11 85	52 34	11 21	53 30	11 34	54 26	11 47	43	40	9
6	47 54	10 18	48 50	10 31	49 46	10 44	50 42	10 57	51 38	11 95	52 34	11 23	53 30	11 35	54 26	11 48	44	41	10
8	47 53	10 19	48 49	10 32	49 45	10 45	50 41	10 58	51 37	11 105	52 33	11 24	53 29	11 36	54 25	11 49	45	42	10
10	47 53	10 20	48 49	10 33	49 45	10 46	50 41	10 59	51 37	11 115	52 33	11 25	53 29	11 38	54 25	11 51	46	43	10
12	47 52	10 21	48 48	10 34	49 44	10 47	50 40	11 05	51 36	11 125	52 32	11 26	53 28	11 39	54 24	11 52	47	44	10
14	47 52	10 22	48 48	10 35	49 44	10 48	50 40	11 15	51 36	11 135	52 32	11 27	53 28	11 40	54 24	11 53	48	45	10
16	47 52	10 23	48 48	10 36	49 43	10 49	50 39	11 25	51 35	11 145	52 31	11 28	53 27	11 41	54 23	11 54	49	46	11
18	47 51	10 24	48 47	10 37	49 43	10 50	50 39	11 35	51 35	11 155	52 31	11 29	53 27	11 42	54 23	11 55	50	47	11
20	47 51	10 25	48 47	10 38	49 43	10 51	50 38	11 45	51 34	11 165	52 30	11 30	53 26	11 43	54 22	11 56	51	48	11
22	47 50	10 26	48 46	10 39	49 42	10 52	50 38	11 55	51 34	11 175	52 30	11 31	53 26	11 44	54 22	11 57	52	49	12
24	47 50	10 27	48 46	10 40	49 42	10 53	50 37	12 05	51 33	11 185	52 29	11 32	53 25	11 45	54 21	11 58	53	50	12
26	47 49	10 28	48 45	10 41	49 41	10 54	50 37	12 15	51 33	11 195	52 29	11 33	53 25	11 47	54 21	12 05	54	51	12
28	47 49	10 29	48 45	10 42	49 41	10 55	50 37	12 25	51 32	11 205	52 28	11 34	53 24	11 48	54 20	12 12	55	52	13
30	47 49	10 30	48 44	10 43	49 40	10 56	50 36	12 35	51 32	11 215	52 28	11 36	53 24	11 49	54 19	12 19	56	53	13
32	47 48	10 31	48 44	10 44	49 40	10 57	50 36	12 45	51 31	11 225	52 27	11 37	53 23	11 50	54 19	12 26	57	54	13
34	47 48	10 32	48 44	10 45	49 39	10 58	50 35	12 55	51 31	11 235	52 27	11 38	53 23	11 51	54 18	12 33	58	55	13
36	47 47	10 33	48 43	10 46	49 39	10 59	50 35	13 05	51 30	11 245	52 26	11 39	53 22	11 52	54 18	12 40	59	56	14
38	47 47	10 34	48 43	10 47	49 38	11 05	50 34	13 15	51 30	11 255	52 26	11 40	53 22	11 53	54 17	12 47	60	57	14
40	47 46	10 35	48 42	10 48	49 38	11 15	50 34	13 25	51 29	11 265	52 25	11 41	53 21	11 54	54 17	12 54	61	58	14
42	47 46	10 36	48 42	10 49	49 37	11 35	50 33	13 35	51 29	11 275	52 25	11 42	53 20	11 56	54 16	12 59	62	59	15
44	47 45	10 37	48 41	10 50	49 37	11 45	50 33	13 45	51 28	11 285	52 24	11 43	53 20	11 57	54 16	13 06	63	60	15
46	47 45	10 38	48 41	10 51	49 36	11 55	50 32	13 55	51 28	11 295	52 24	11 44	53 19	11 58	54 15	13 13	64	61	15
48	47 45	10 39	48 40	10 52	49 36	12 05	50 32	14 05	51 27	11 305	52 23	11 46	53 19	11 59	54 15	13 20	65	62	16
50	47 44	10 40	48 40	10 53	49 35	12 15	50 31	14 15	51 27	11 315	52 23	11 47	53 18	12 05	54 14	13 27	66	63	16
52	47 44	10 41	48 39	10 54	49 35	12 25	50 31	14 25	51 26	11 325	52 22	11 48	53 18	12 15	54 13	13 34	67	64	16
54	47 43	10 42	48 39	10 55	49 35	12 35	50 30	14 35	51 26	11 335	52 22	11 49	53 17	12 25	54 13	13 41	68	65	17
56	47 43	10 43	48 38	10 56	49 34	12 45	50 30	14 45	51 25	11 345	52 21	11 50	53 17	12 35	54 12	13 48	69	66	17
58	47 42	10 44	48 38	10 57	49 34	12 55	50 29	14 55	51 25	11 355	52 21	11 51	53 16	12 45	54 12	13 55	70	67	18

(22° and 23°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
22°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	47 42	10 45	48 37	10 58	49 33	11 12	50 29	11 25	51 24	11 39	52 20	11 52	53 16	12 6	54 11	12 19	1	0
2	47 41	10 46	48 37	11 0	49 32	11 13	50 28	11 26	51 24	11 40	52 19	11 53	53 15	12 7	54 11	12 20	2	0
4	47 41	10 47	48 36	11 1	49 32	11 14	50 28	11 27	51 23	11 41	52 19	11 54	53 14	12 8	54 10	12 21	3	1
6	47 40	10 48	48 36	11 2	49 31	11 15	50 27	11 29	51 23	11 42	52 18	11 55	53 14	12 9	54 10	12 22	4	1
8	47 40	10 49	48 35	11 3	49 31	11 16	50 27	11 30	51 22	11 43	52 18	11 57	53 13	12 10	54 9	12 24	5	1
10	47 39	10 50	48 35	11 4	49 30	11 17	50 26	11 31	51 22	11 44	52 17	11 58	53 13	12 11	54 8	12 25	6	1
12	47 39	10 51	48 34	11 5	49 30	11 18	50 26	11 32	51 21	11 45	52 17	11 59	53 12	12 12	54 8	12 26	7	1
14	47 38	10 52	48 34	11 6	49 29	11 19	50 25	11 33	51 21	11 46	52 16	12 0	53 12	12 13	54 7	12 27	8	1
16	47 38	10 53	48 33	11 7	49 29	11 20	50 24	11 34	51 20	11 47	52 16	12 1	53 11	12 15	54 7	12 28	9	1
18	47 37	10 54	48 33	11 8	49 28	11 21	50 24	11 35	51 20	11 49	52 15	12 2	53 11	12 16	54 6	12 29	10	1
20	47 37	10 55	48 32	11 9	49 28	11 22	50 23	11 36	51 19	11 50	52 14	12 3	53 10	12 17	54 5	12 30	11	1
22	47 36	10 56	48 32	11 10	49 27	11 23	50 23	11 37	51 18	11 51	52 14	12 4	53 9	12 18	54 5	12 32	12	1
24	47 36	10 57	48 31	11 11	49 27	11 24	50 22	11 38	51 18	11 52	52 13	12 5	53 9	12 19	54 4	12 33	13	1
26	47 35	10 58	48 31	11 12	49 26	11 25	50 22	11 39	51 17	11 53	52 13	12 6	53 8	12 20	54 4	12 34	14	1
28	47 35	10 59	48 30	11 13	49 26	11 26	50 21	11 40	51 17	11 54	52 12	12 7	53 8	12 21	54 3	12 35	15	1
30	47 34	11 0	48 30	11 14	49 25	11 27	50 21	11 41	51 16	11 55	52 12	12 8	53 7	12 22	54 3	12 36	16	1
32	47 34	11 1	48 29	11 15	49 25	11 28	50 20	11 42	51 16	11 56	52 11	12 10	53 7	12 23	54 2	12 37	17	1
34	47 33	11 2	48 29	11 16	49 24	11 30	50 20	11 43	51 15	11 57	52 11	12 11	53 6	12 25	54 1	12 38	18	1
36	47 33	11 3	48 28	11 17	49 24	11 31	50 19	11 44	51 15	11 58	52 10	12 12	53 5	12 26	54 1	12 39	19	1
38	47 32	11 4	48 28	11 18	49 23	11 32	50 19	11 45	51 14	11 59	52 9	12 13	53 5	12 27	54 0	12 41	20	1
40	47 32	11 5	48 27	11 19	49 23	11 33	50 18	11 46	51 13	12 0	52 9	12 14	53 4	12 28	54 0	12 42	21	1
42	47 31	11 6	48 27	11 20	49 22	11 34	50 17	11 47	51 13	12 1	52 8	12 15	53 4	12 29	53 59	12 43	22	1
44	47 31	11 7	48 26	11 21	49 22	11 35	50 17	11 49	51 12	12 2	52 8	12 16	53 3	12 30	53 58	12 44	23	1
46	47 30	11 8	48 26	11 22	49 21	11 36	50 16	11 50	51 12	12 3	52 7	12 17	53 2	12 31	53 58	12 45	24	1
48	47 30	11 9	48 25	11 23	49 20	11 37	50 16	11 51	51 11	12 4	52 6	12 18	53 2	12 32	53 57	12 46	25	1
50	47 29	11 10	48 25	11 24	49 20	11 38	50 15	11 52	51 11	12 5	52 6	12 19	53 1	12 33	53 57	12 47	26	1
52	47 29	11 11	48 24	11 25	49 19	11 39	50 15	11 53	51 10	12 6	52 5	12 21	53 1	12 34	53 56	12 48	27	1
54	47 28	11 12	48 24	11 26	49 19	11 40	50 14	11 54	51 9	12 7	52 5	12 22	53 0	12 36	53 55	12 50	28	1
56	47 28	11 13	48 23	11 27	49 18	11 41	50 14	11 55	51 9	12 8	52 4	12 23	52 59	12 37	53 55	12 51	29	1
58	47 27	11 14	48 23	11 28	49 18	11 42	50 13	11 56	51 8	12 9	52 4	12 24	52 59	12 38	53 54	12 52	30	1
23°	54'	55'	56'	57'	58'	59'	60'	61'										
0'	47 27	11 15	48 22	11 29	49 17	11 43	50 12	11 57	51 8	12 11	52 3	12 25	52 58	12 39	53 53	12 53	31	1
2	47 26	11 16	48 21	11 30	49 17	11 44	50 12	11 58	51 7	12 12	52 2	12 26	52 58	12 40	53 53	12 54	32	1
4	47 26	11 17	48 21	11 31	49 16	11 45	50 11	11 59	51 7	12 13	52 2	12 27	52 57	12 41	53 52	12 55	33	1
6	47 25	11 18	48 20	11 32	49 16	11 46	50 11	12 0	51 6	12 14	52 1	12 28	52 56	12 42	53 52	12 56	34	1
8	47 25	11 19	48 20	11 33	49 15	11 47	50 10	12 1	51 5	12 15	52 1	12 29	52 56	12 43	53 51	12 57	35	1
10	47 24	11 20	48 19	11 34	49 14	11 48	50 10	12 2	51 5	12 16	52 0	12 30	52 55	12 44	53 50	12 58	36	1
12	47 24	11 21	48 19	11 35	49 14	11 49	50 9	12 3	51 4	12 17	51 59	12 31	52 55	12 45	53 50	13 0	37	1
14	47 23	11 22	48 18	11 36	49 13	11 50	50 9	12 4	51 4	12 18	51 59	12 33	52 54	12 47	53 49	13 1	38	1
16	47 23	11 23	48 18	11 37	49 13	11 51	50 8	12 5	51 3	12 19	51 58	12 34	52 53	12 48	53 49	13 2	39	1
18	47 22	11 24	48 17	11 38	49 12	11 52	50 7	12 6	51 3	12 21	51 58	12 35	52 53	12 49	53 48	13 3	40	1
20	47 21	11 25	48 17	11 39	49 12	11 53	50 7	12 7	51 2	12 22	51 57	12 36	52 52	12 50	53 47	13 4	41	1
22	47 21	11 26	48 16	11 40	49 11	11 54	50 6	12 8	51 1	12 23	51 56	12 37	52 52	12 51	53 47	13 5	42	1
24	47 20	11 27	48 15	11 41	49 11	11 55	50 6	12 10	51 1	12 24	51 56	12 38	52 51	12 52	53 46	13 6	43	1
26	47 20	11 28	48 15	11 42	49 10	11 56	50 5	12 11	51 0	12 25	51 55	12 39	52 50	12 53	53 45	13 7	44	1
28	47 19	11 29	48 14	11 43	49 9	11 57	50 5	12 12	51 0	12 26	51 55	12 40	52 50	12 54	53 45	13 8	45	1
30	47 19	11 30	48 14	11 44	49 9	11 58	50 4	12 13	50 59	12 27	51 54	12 41	52 49	12 55	53 44	13 10	46	1
32	47 18	11 31	48 13	11 45	49 8	11 59	50 3	12 14	50 58	12 28	51 53	12 42	52 48	12 56	53 44	13 11	47	1
34	47 18	11 32	48 13	11 46	49 8	12 0	50 3	12 15	50 58	12 29	51 53	12 43	52 48	12 58	53 43	13 12	48	1
36	47 17	11 33	48 12	11 47	49 7	12 1	50 2	12 16	50 57	12 30	51 52	12 44	52 47	12 59	53 42	13 13	49	1
38	47 17	11 34	48 12	11 48	49 7	12 2	50 2	12 17	50 57	12 31	51 52	12 46	52 47	13 0	53 42	13 14	50	1
40	47 16	11 35	48 11	11 49	49 6	12 3	50 1	12 18	50 56	12 32	51 51	12 47	52 46	13 1	53 41	13 15	51	1
42	47 16	11 36	48 11	11 50	49 6	12 4	50 0	12 19	50 55	12 33	51 50	12 48	52 45	13 2	53 40	13 16	52	1
44	47 15	11 37	48 10	11 51	49 5	12 5	50 0	12 20	50 55	12 34	51 50	12 49	52 45	13 3	53 40	13 18	53	1
46	47 14	11 38	48 9	11 52	49 4	12 7	49 59	12 21	50 54	12 35	51 49	12 50	52 44	13 4	53 39	13 19	54	1
48	47 14	11 39	48 9	11 53	49 4	12 8	49 59	12 22	50 54	12 37	51 48	12 51	52 43	13 5	53 38	13 20	55	1
50	47 13	11 40	48 8	11 54	49 3	12 9	49 58	12 23	50 53	12 38	51 48	12 52	52 43	13 6	53 38	13 21	56	1
52	47 13	11 41	48 8	11 55	49 3	12 10	49 57	12 24	50 52	12 39	51 47	12 53	52 42	13 7	53 37	13 22	57	1
54	47 12	11 42	48 7	11 56	49 2	12 11	49 57	12 25	50 52	12 40	51 47	12 54	52 42	13 8	53 36	13 23	58	1
56	47 12	11 43	48 7	11 57	49 1	12 12	49 56	12 26	50 51	12 41	51 46	12 55	52 41	13 10	53 36	13 24	59	1
58	47 11	11 44	48 6	11 58	49 1	12 13	49 56	12 27	50 51	12 42	51 45	12 56	52 40	13 11	53 35	13 25	60	1

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (24° and 25°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	"	"
24°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"	"
0'	47 11	11 45	48 5	11 59	49 0	12 14	49 55	12 28	50 50	12 43	51 45	12 57	52 40	13 12	53 34	13 26	1	1	0
2	47 10	11 46	48 5	12 0	49 0	12 15	49 54	12 29	50 49	12 44	51 44	12 58	52 39	13 13	53 34	13 28	2	2	1
4	47 9	11 47	48 4	12 1	48 59	12 16	49 54	12 30	50 49	12 45	51 43	13 0	52 38	13 14	53 33	13 29	3	3	1
6	47 9	11 48	48 4	12 2	48 58	12 17	49 53	12 31	50 48	12 46	51 43	13 1	52 38	13 15	53 32	13 30	4	4	1
8	47 8	11 49	48 3	12 3	48 58	12 18	49 53	12 33	50 47	12 47	51 42	13 2	52 37	13 16	53 32	13 31	5	5	1
10	47 8	11 50	48 2	12 4	48 57	12 19	49 52	12 34	50 47	12 48	51 41	13 3	52 36	13 17	53 31	13 32	6	6	2
12	47 7	11 51	48 2	12 5	48 57	12 20	49 51	12 35	50 46	12 49	51 41	13 4	52 36	13 19	53 30	13 33	7	7	2
14	47 7	11 52	48 1	12 6	48 56	12 21	49 51	12 36	50 45	12 50	51 40	13 5	52 35	13 20	53 30	13 34	8	8	2
16	47 6	11 53	48 1	12 7	48 55	12 22	49 50	12 37	50 45	12 51	51 40	13 6	52 34	13 21	53 29	13 35	9	9	2
18	47 5	11 54	48 0	12 8	48 55	12 23	49 50	12 38	50 44	12 52	51 39	13 7	52 34	13 22	53 28	13 36	10	10	3
20	47 5	11 55	48 0	12 9	48 54	12 24	49 49	12 39	50 44	12 53	51 38	13 8	52 33	13 23	53 28	13 38	11	11	3
22	47 4	11 56	47 59	12 10	48 54	12 25	49 48	12 40	50 43	12 55	51 38	13 9	52 32	13 24	53 27	13 39	12	12	3
24	47 4	11 57	47 58	12 11	48 53	12 26	49 48	12 41	50 42	12 56	51 37	13 10	52 32	13 25	53 26	13 40	13	13	3
26	47 3	11 58	47 58	12 12	48 52	12 27	49 47	12 42	50 42	12 57	51 36	13 11	52 31	13 26	53 26	13 41	14	14	3
28	47 3	11 59	47 57	12 13	48 52	12 28	49 46	12 43	50 41	12 58	51 35	13 12	52 30	13 27	53 25	13 42	15	15	3
30	47 2	12 0	47 57	12 14	48 51	12 29	49 46	12 44	50 40	12 59	51 35	13 14	52 30	13 28	53 24	13 43	16	16	3
32	47 1	12 1	47 56	12 15	48 51	12 30	49 45	12 45	50 40	13 0	51 34	13 15	52 29	13 29	53 24	13 44	17	17	3
34	47 1	12 2	47 55	12 16	48 50	12 31	49 44	12 46	50 39	13 1	51 34	13 16	52 28	13 31	53 23	13 45	18	18	3
36	47 0	12 3	47 55	12 17	48 49	12 32	49 44	12 47	50 38	13 2	51 33	13 17	52 28	13 32	53 22	13 46	19	19	3
38	47 0	12 4	47 54	12 18	48 49	12 33	49 43	12 48	50 38	13 3	51 32	13 18	52 27	13 33	53 21	13 48	20	20	3
40	46 59	12 4	47 53	12 19	48 48	12 34	49 43	12 49	50 37	13 4	51 32	13 19	52 26	13 34	53 21	13 49	21	21	3
42	46 58	12 5	47 53	12 20	48 47	12 35	49 42	12 50	50 37	13 5	51 31	13 20	52 26	13 35	53 20	13 50	22	22	3
44	46 58	12 6	47 52	12 21	48 47	12 36	49 41	12 51	50 36	13 6	51 31	13 21	52 25	13 36	53 19	13 51	23	23	3
46	46 57	12 7	47 52	12 22	48 46	12 37	49 41	12 52	50 35	13 7	51 30	13 22	52 24	13 37	53 19	13 52	24	24	3
48	46 57	12 8	47 51	12 23	48 46	12 38	49 40	12 53	50 35	13 8	51 29	13 23	52 24	13 38	53 18	13 53	25	25	3
50	46 56	12 9	47 50	12 24	48 45	12 39	49 39	12 54	50 34	13 9	51 28	13 24	52 23	13 39	53 17	13 54	26	26	3
52	46 55	12 10	47 50	12 25	48 44	12 40	49 39	12 55	50 33	13 10	51 28	13 25	52 22	13 40	53 17	13 55	27	27	3
54	46 55	12 11	47 49	12 26	48 44	12 41	49 38	12 56	50 33	13 11	51 27	13 26	52 22	13 41	53 16	13 56	28	28	3
56	46 54	12 12	47 49	12 27	48 43	12 42	49 38	12 57	50 32	13 12	51 26	13 28	52 21	13 43	53 15	13 58	29	29	3
58	46 54	12 13	47 48	12 28	48 43	12 43	49 37	12 58	50 31	13 14	51 26	13 29	52 20	13 44	53 15	13 59	30	30	3
25°	54'	55'	56'	57'	58'	59'	60'	61'									31	31	10
0'	46 53	12 14	47 47	12 29	48 42	12 44	49 36	12 59	50 31	13 15	51 25	13 30	52 19	13 45	53 14	14 0	32	32	10
2	46 52	12 15	47 47	12 30	48 41	12 45	49 36	13 0	50 30	13 16	51 24	13 31	52 19	13 46	53 13	14 1	33	33	11
4	46 52	12 16	47 46	12 31	48 41	12 46	49 35	13 1	50 29	13 17	51 24	13 32	52 18	13 47	53 12	14 2	34	34	11
6	46 51	12 17	47 46	12 32	48 40	12 47	49 34	13 2	50 29	13 18	51 23	13 33	52 17	13 48	53 12	14 3	35	35	11
8	46 51	12 18	47 45	12 33	48 39	12 48	49 34	13 3	50 28	13 19	51 22	13 34	52 17	13 49	53 11	14 4	36	36	11
10	46 50	12 19	47 44	12 34	48 39	12 49	49 33	13 4	50 27	13 20	51 22	13 35	52 16	13 50	53 10	14 5	37	37	11
12	46 49	12 20	47 44	12 35	48 38	12 51	49 32	13 5	50 27	13 21	51 21	13 36	52 15	13 51	53 9	14 6	38	38	11
14	46 49	12 21	47 43	12 36	48 37	12 52	49 32	13 6	50 26	13 22	51 20	13 37	52 14	13 52	53 9	14 7	39	39	11
16	46 48	12 22	47 42	12 37	48 37	12 53	49 31	13 7	50 25	13 23	51 19	13 38	52 14	13 53	53 8	14 9	40	40	11
18	46 47	12 23	47 42	12 38	48 36	12 54	49 30	13 8	50 24	13 24	51 19	13 39	52 13	13 55	53 7	14 10	41	41	11
20	46 47	12 24	47 41	12 39	48 35	12 55	49 30	13 9	50 24	13 25	51 18	13 40	52 12	13 56	53 7	14 11	42	42	11
22	46 46	12 25	47 40	12 40	48 35	12 56	49 29	13 10	50 23	13 26	51 17	13 41	52 12	13 57	53 6	14 12	43	43	11
24	46 46	12 26	47 40	12 41	48 34	12 57	49 28	13 11	50 22	13 27	51 17	13 42	52 11	13 58	53 5	14 13	44	44	11
26	46 45	12 27	47 39	12 42	48 33	12 58	49 28	13 12	50 21	13 28	51 16	13 43	52 10	13 59	53 4	14 14	45	45	11
28	46 44	12 28	47 38	12 43	48 33	12 59	49 27	13 13	50 21	13 29	51 15	13 45	52 9	14 0	53 4	14 15	46	46	11
30	46 44	12 29	47 38	12 44	48 32	13 0	49 26	13 14	50 20	13 30	51 15	13 46	52 8	14 1	53 3	14 16	47	47	11
32	46 43	12 30	47 37	12 45	48 31	13 1	49 26	13 15	50 20	13 31	51 14	13 47	52 7	14 2	53 2	14 17	48	48	11
34	46 42	12 31	47 37	12 46	48 31	13 2	49 25	13 16	50 19	13 32	51 13	13 48	52 6	14 3	53 1	14 18	49	49	11
36	46 42	12 32	47 36	12 47	48 30	13 3	49 24	13 17	50 18	13 33	51 12	13 49	52 5	14 4	53 0	14 19	50	50	11
38	46 41	12 33	47 35	12 48	48 30	13 4	49 23	13 18	50 18	13 34	51 11	13 50	52 4	14 5	53 0	14 20	51	51	11
40	46 40	12 34	47 35	12 49	48 29	13 5	49 23	13 19	50 17	13 35	51 10	13 51	52 3	14 6	53 0	14 21	52	52	11
42	46 40	12 35	47 34	12 50	48 28	13 6	49 22	13 20	50 16	13 36	51 9	13 52	52 2	14 7	53 0	14 22	53	53	11
44	46 39	12 36	47 33	12 51	48 27	13 7	49 21	13 21	50 16	13 37	51 8	13 53	52 1	14 8	53 0	14 23	54	54	11
46	46 39	12 37	47 33	12 52	48 27	13 8	49 21	13 22	50 15	13 38	51 7	13 54	52 0	14 9	53 0	14 24	55	55	11
48	46 38	12 38	47 32	12 53	48 26	13 9	49 20	13 23	50 14	13 39	51 6	13 55	52 0	14 10	53 0	14 25	56	56	11
50	46 37	12 39	47 31	12 54	48 25	13 10	49 19	13 24	50 13	13 40	51 5	13 56	52 0	14 11	53 0	14 26	57	57	11
52	46 37	12 40	47 31	12 55	48 25	13 11	49 19	13 25	50 13	13 41	51 4	13 57	52 0	14 12	53 0	14 27	58	58	11
54	46 36	12 41	47 30	12 56	48 24	13 12	49 18	13 26	50 12	13 42	51 3	13 58	52 0	14 13	53 0	14 28	59	59	11
56	46 35	12 42	47 29	12 57	48 23	13 13	49 17	13 27	50 11	13 43	51 2	13 59	52 0	14 14	53 0	14 29	60	60	11
58	46 35	12 43	47 29	12 58	48 23	13 14	49 17	13 28	50 11	13 44	51 1	14 0	52 0	14 15	53 0	14 30	61	61	11

(26° and 27°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	A
	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°		
26°																	1	0
0'	46 34	12 44	47 28	12 59	48 22	13 15	49 16	13 30	50 10	13 46	51 41	14 25	51 58	14 17	52 52	14 33	2	1
2	46 33	12 45	47 27	13 0	48 21	13 16	49 15	13 31	50 9	13 47	51 34	14 35	51 57	14 18	52 51	14 34	3	1
4	46 33	12 46	47 27	13 1	48 21	13 17	49 14	13 32	50 8	13 48	51 24	14 45	51 56	14 19	52 50	14 35	5	1
6	46 32	12 47	47 26	13 2	48 20	13 18	49 14	13 33	50 7	13 49	51 14	14 51	51 56	14 20	52 49	14 36	6	2
8	46 31	12 47	47 25	13 3	48 19	13 19	49 13	13 35	50 7	13 50	51 14	14 51	51 55	14 22	52 49	14 37	7	2
10	46 31	12 48	47 25	13 4	48 19	13 20	49 12	13 36	50 6	13 51	51 0	14 51	51 54	14 23	52 48	14 38	8	2
12	46 30	12 49	47 24	13 5	48 18	13 21	49 12	13 37	50 6	13 52	50 59	14 51	51 53	14 24	52 47	14 39	9	3
14	46 29	12 50	47 23	13 6	48 17	13 22	49 11	13 38	50 5	13 53	50 59	14 51	51 53	14 25	52 46	14 40	10	3
16	46 29	12 51	47 23	13 7	48 16	13 23	49 10	13 39	50 4	13 54	50 58	14 51	51 52	14 26	52 46	14 42	11	3
18	46 28	12 52	47 22	13 8	48 16	13 24	49 10	13 40	50 3	13 55	50 57	14 51	51 51	14 27	52 45	14 43	12	4
20	46 27	12 53	47 21	13 9	48 15	13 25	49 9	13 41	50 3	13 56	50 56	14 51	51 50	14 28	52 44	14 44	13	4
22	46 27	12 54	47 21	13 10	48 14	13 26	49 8	13 42	50 2	13 57	50 56	14 51	51 50	14 29	52 43	14 45	14	4
24	46 26	12 55	47 20	13 11	48 14	13 27	49 7	13 43	50 1	13 58	50 55	14 51	51 49	14 30	52 42	14 46	15	5
26	46 25	12 56	47 19	13 12	48 13	13 28	49 6	13 44	50 0	13 59	50 54	14 51	51 48	14 31	52 42	14 47	16	5
28	46 25	12 57	47 18	13 13	48 13	13 29	49 5	13 45	50 0	14 0	50 53	14 51	51 47	14 32	52 41	14 48	17	5
30	46 24	12 58	47 18	13 14	48 12	13 30	49 4	13 46	49 59	14 2	50 53	14 51	51 46	14 33	52 40	14 49	18	6
32	46 23	12 59	47 17	13 15	48 11	13 31	49 3	13 47	49 58	14 3	50 52	14 51	51 45	14 34	52 39	14 50	19	6
34	46 23	13 0	47 16	13 16	48 11	13 32	49 2	13 48	49 57	14 4	50 51	14 51	51 44	14 35	52 38	14 51	20	6
36	46 22	13 1	47 16	13 17	48 9	13 33	49 1	13 49	49 57	14 5	50 50	14 51	51 44	14 36	52 38	14 52	21	6
38	46 21	13 2	47 15	13 18	48 9	13 34	49 1	13 50	49 56	14 6	50 50	14 51	51 43	14 37	52 37	14 53	22	7
40	46 21	13 3	47 14	13 19	48 8	13 35	49 1	13 51	49 55	14 7	50 49	14 51	51 43	14 39	52 36	14 55	23	7
42	46 20	13 4	47 14	13 20	48 7	13 36	49 1	13 52	49 54	14 8	50 48	14 51	51 42	14 40	52 35	14 56	24	7
44	46 19	13 5	47 13	13 21	48 7	13 37	49 0	13 53	49 54	14 9	50 47	14 51	51 41	14 41	52 35	14 57	25	8
46	46 19	13 6	47 12	13 22	48 6	13 38	48 59	13 54	49 53	14 10	50 47	14 51	51 40	14 42	52 34	14 58	26	8
48	46 18	13 7	47 12	13 23	48 5	13 39	48 59	13 55	49 52	14 11	50 46	14 51	51 39	14 43	52 33	14 59	27	9
50	46 17	13 8	47 11	13 24	48 4	13 40	48 58	13 56	49 51	14 12	50 45	14 51	51 39	14 44	52 32	15 0	28	9
52	46 17	13 9	47 10	13 25	48 4	13 41	48 57	13 57	49 51	14 13	50 44	14 51	51 38	14 45	52 31	15 1	29	9
54	46 16	13 10	47 9	13 26	48 3	13 42	48 56	13 58	49 50	14 14	50 44	14 51	51 37	14 46	52 31	15 2	30	10
56	46 15	13 11	47 9	13 27	48 2	13 43	48 56	13 59	49 49	14 15	50 43	14 51	51 36	14 47	52 30	15 3	31	10
58	46 15	13 12	47 8	13 28	48 2	13 44	48 55	14 0	49 49	14 16	50 42	14 51	51 35	14 48	52 29	15 4	32	10
27°																	33	10
0'	46 14	13 13	47 7	13 29	48 1	13 45	48 54	14 1	49 48	14 17	50 41	14 51	51 35	14 49	52 28	15 5	41	11
2	46 13	13 14	47 7	13 30	48 0	13 46	48 54	14 2	49 47	14 18	50 41	14 51	51 34	14 50	52 27	15 6	42	11
4	46 12	13 14	47 6	13 31	47 59	13 47	48 53	14 3	49 46	14 19	50 40	14 51	51 33	14 52	52 27	15 7	43	11
6	46 12	13 15	47 5	13 32	47 59	13 48	48 52	14 4	49 46	14 20	50 39	14 51	51 32	14 53	52 26	15 8	44	12
8	46 11	13 16	47 5	13 33	47 58	13 49	48 51	14 5	49 45	14 21	50 38	14 51	51 32	14 54	52 25	15 10	45	12
10	46 10	13 17	47 4	13 34	47 57	13 50	48 51	14 6	49 44	14 22	50 37	14 51	51 31	14 55	52 24	15 11	46	12
12	46 10	13 18	47 3	13 35	47 56	13 51	48 50	14 7	49 43	14 23	50 37	14 51	51 30	14 56	52 23	15 12	47	13
14	46 9	13 19	47 2	13 36	47 55	13 52	48 49	14 8	49 42	14 24	50 36	14 51	51 29	14 57	52 23	15 13	48	13
16	46 8	13 20	47 2	13 36	47 55	13 53	48 48	14 9	49 42	14 25	50 36	14 51	51 28	14 58	52 22	15 14	49	14
18	46 8	13 21	47 1	13 37	47 54	13 54	48 48	14 10	49 41	14 26	50 34	14 51	51 28	14 59	52 21	15 15	50	14
20	46 7	13 22	47 0	13 38	47 53	13 55	48 47	14 11	49 40	14 27	50 33	14 51	51 27	15 0	52 20	15 16	51	14
22	46 6	13 23	46 59	13 39	47 53	13 56	48 46	14 12	49 39	14 28	50 33	14 51	51 26	15 1	52 19	15 17	52	15
24	46 5	13 24	46 59	13 40	47 52	13 57	48 45	14 13	49 39	14 29	50 32	14 51	51 25	15 2	52 18	15 19	53	15
26	46 5	13 25	46 58	13 41	47 51	13 58	48 44	14 14	49 38	14 30	50 31	14 51	51 24	15 3	52 18	15 20	54	15
28	46 4	13 26	46 57	13 42	47 50	13 59	48 44	14 15	49 37	14 32	50 30	14 51	51 23	15 4	52 17	15 21	55	16
30	46 3	13 27	46 56	13 43	47 50	14 0	48 43	14 16	49 36	14 33	50 29	14 51	51 23	15 5	52 16	15 22	56	16
32	46 3	13 28	46 56	13 44	47 49	14 1	48 42	14 17	49 35	14 34	50 29	14 51	51 22	15 6	52 15	15 23	57	16
34	46 2	13 29	46 55	13 45	47 49	14 2	48 41	14 18	49 35	14 35	50 28	14 51	51 21	15 7	52 14	15 24	58	16
36	46 1	13 30	46 54	13 46	47 47	14 3	48 41	14 19	49 34	14 36	50 27	14 52	51 20	15 8	52 13	15 25	59	16
38	46 0	13 31	46 54	13 47	47 47	14 4	48 40	14 20	49 33	14 37	50 26	14 53	51 19	15 10	52 13	15 26	60	16
40	46 0	13 32	46 53	13 48	47 46	14 5	48 39	14 21	49 32	14 38	50 25	14 54	51 19	15 11	52 12	15 27	61	16
42	45 59	13 33	46 52	13 49	47 45	14 6	48 38	14 22	49 32	14 39	50 25	14 55	51 18	15 12	52 11	15 28	62	16
44	45 58	13 34	46 51	13 50	47 44	14 7	48 38	14 23	49 31	14 40	50 24	14 56	51 17	15 13	52 10	15 29	63	16
46	45 57	13 35	46 51	13 51	47 44	14 8	48 37	14 24	49 30	14 41	50 23	14 57	51 16	15 14	52 9	15 30	64	16
48	45 57	13 36	46 50	13 52	47 43	14 9	48 36	14 25	49 29	14 42	50 22	14 58	51 15	15 15	52 8	15 31	65	16
50	45 56	13 36	46 49	13 53	47 42	14 10	48 35	14 26	49 28	14 43	50 21	14 59	51 14	15 16	52 7	15 32	66	16
52	45 55	13 37	46 48	13 54	47 41	14 11	48 35	14 27	49 28	14 44	50 21	15 0	51 14	15 17	52 6	15 33	67	16
54	45 55	13 38	46 48	13 55	47 41	14 12	48 34	14 28	49 27	14 45	50 20	15 1	51 13	15 18	52 5	15 34	68	16
56	45 54	13 39	46 47	13 56	47 40	14 13	48 33	14 29	49 26	14 46	50 19	15 2	51 12	15 19	52 4	15 35	69	16
58	45 53	13 40	46 46	13 57	47 39	14 14	48 32	14 30	49 25	14 47	50 18	15 3	51 11	15 20	52 3	15 36	70	16

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (28° and 29°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		Cor.	A
28°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	45 52	13 41	46 45	13 58	47 38	14 15	48 31	14 31	49 24	14 48	50 17	15 5	51 10	15 21	52 3	15 38	1	0
2	45 52	13 42	46 45	13 59	47 38	14 16	48 31	14 32	49 24	14 49	50 17	15 6	51 10	15 22	52 3	15 39	2	1
4	45 51	13 43	46 44	14 0	47 37	14 17	48 30	14 33	49 23	14 50	50 16	15 7	51 9	15 23	52 2	15 40	3	1
6	45 50	13 44	46 43	14 1	47 36	14 18	48 29	14 34	49 22	14 51	50 15	15 8	51 8	15 24	52 1	15 41	4	1
8	45 49	13 45	46 42	14 2	47 35	14 19	48 28	14 35	49 21	14 52	50 14	15 9	51 7	15 25	52 0	15 42	5	2
10	45 49	13 46	46 42	14 3	47 35	14 20	48 27	14 36	49 20	14 53	50 13	15 10	51 6	15 27	51 59	15 43	6	2
12	45 48	13 47	46 41	14 4	47 34	14 21	48 27	14 37	49 20	14 54	50 12	15 11	51 5	15 28	51 58	15 44	7	2
14	45 47	13 48	46 40	14 5	47 33	14 22	48 26	14 38	49 19	14 55	50 11	15 12	51 5	15 29	51 57	15 45	8	3
16	45 46	13 49	46 39	14 6	47 32	14 23	48 25	14 39	49 18	14 56	50 10	15 13	51 4	15 30	51 57	15 47	9	3
18	45 46	13 50	46 38	14 7	47 31	14 24	48 24	14 40	49 17	14 57	50 10	15 14	51 3	15 31	51 56	15 48	10	3
20	45 45	13 51	46 38	14 8	47 31	14 24	48 23	14 41	49 16	14 58	50 9	15 15	51 2	15 32	51 55	15 49	11	3
22	45 44	13 52	46 37	14 9	47 30	14 25	48 23	14 42	49 15	14 59	50 8	15 16	51 1	15 33	51 54	15 50	12	3
24	45 43	13 53	46 36	14 10	47 29	14 26	48 22	14 43	49 15	15 0	50 8	15 17	51 0	15 34	51 53	15 51	13	4
26	45 43	13 54	46 36	14 11	47 28	14 27	48 21	14 44	49 14	15 1	50 7	15 18	51 0	15 35	51 52	15 52	14	4
28	45 42	13 55	46 35	14 11	47 28	14 28	48 20	14 45	49 13	15 2	50 6	15 19	50 59	15 36	51 51	15 53	15	4
30	45 41	13 56	46 34	14 12	47 27	14 29	48 20	14 46	49 12	15 3	50 5	15 20	50 58	15 37	51 50	15 54	16	5
32	45 40	13 56	46 33	14 13	47 26	14 30	48 19	14 47	49 11	15 4	50 4	15 21	50 57	15 38	51 50	15 55	17	5
34	45 40	13 57	46 32	14 14	47 25	14 31	48 18	14 48	49 11	15 5	50 3	15 22	50 56	15 39	51 49	15 56	18	5
36	45 39	13 58	46 32	14 15	47 24	14 32	48 17	14 49	49 10	15 6	50 2	15 23	50 55	15 40	51 48	15 57	19	6
38	45 38	13 59	46 31	14 16	47 24	14 33	48 16	14 50	49 9	15 7	50 2	15 24	50 54	15 41	51 47	15 58	20	6
40	45 37	14 0	46 30	14 17	47 23	14 34	48 15	14 51	49 8	15 8	50 1	15 25	50 53	15 42	51 46	15 59	21	6
42	45 37	14 1	46 29	14 18	47 22	14 35	48 15	14 52	49 7	15 9	50 0	15 26	50 53	15 43	51 45	16 0	22	7
44	45 36	14 2	46 29	14 19	47 21	14 36	48 14	14 53	49 6	15 10	49 59	15 28	50 52	15 45	51 44	16 1	23	7
46	45 35	14 3	46 28	14 20	47 20	14 37	48 13	14 54	49 5	15 12	49 58	15 29	50 51	15 46	51 43	16 2	24	7
48	45 34	14 4	46 27	14 21	47 20	14 38	48 12	14 55	49 4	15 13	49 57	15 30	50 50	15 47	51 43	16 3	25	8
50	45 34	14 5	46 26	14 22	47 19	14 39	48 11	14 56	49 3	15 14	49 56	15 31	50 49	15 48	51 42	16 4	26	8
52	45 33	14 6	46 25	14 23	47 18	14 40	48 11	14 57	49 2	15 15	49 56	15 32	50 48	15 49	51 41	16 5	27	8
54	45 32	14 7	46 25	14 24	47 17	14 41	48 10	14 58	49 1	15 16	49 55	15 33	50 47	15 50	51 40	16 6	28	8
56	45 31	14 8	46 24	14 25	47 16	14 42	48 9	14 59	49 0	15 17	49 54	15 34	50 46	15 51	51 39	16 7	29	8
58	45 31	14 9	46 23	14 26	47 16	14 43	48 8	15 0	49 0	15 18	49 53	15 35	50 46	15 52	51 38	16 8	30	8
29°	54'		55'		56'		57'		58'		59'		60'		61'			
0'	45 30	14 10	46 22	14 27	47 15	14 44	48 7	15 2	49 0	15 19	49 52	15 36	50 45	15 53	51 37	16 10	31	8
2	45 29	14 11	46 22	14 28	47 14	14 45	48 6	15 3	48 59	15 20	49 51	15 37	50 44	15 54	51 36	16 11	32	8
4	45 28	14 12	46 21	14 29	47 13	14 46	48 5	15 4	48 58	15 21	49 50	15 38	50 43	15 55	51 36	16 12	33	8
6	45 27	14 13	46 20	14 30	47 12	14 47	48 5	15 5	48 57	15 22	49 50	15 39	50 42	15 56	51 35	16 13	34	8
8	45 27	14 13	46 19	14 31	47 12	14 48	48 4	15 5	48 56	15 23	49 49	15 40	50 41	15 57	51 34	16 14	35	8
10	45 26	14 14	46 18	14 32	47 11	14 49	48 3	15 6	48 56	15 24	49 48	15 41	50 40	15 58	51 33	16 15	36	8
12	45 25	14 15	46 18	14 33	47 10	14 50	48 2	15 7	48 55	15 25	49 47	15 42	50 40	15 59	51 32	16 16	37	8
14	45 24	14 16	46 17	14 34	47 9	14 51	48 2	15 8	48 54	15 26	49 46	15 43	50 39	16 0	51 31	16 17	38	8
16	45 24	14 17	46 16	14 35	47 8	14 52	48 1	15 9	48 53	15 27	49 45	15 44	50 38	16 1	51 30	16 19	39	8
18	45 23	14 18	46 15	14 36	47 7	14 53	48 0	15 10	48 52	15 28	49 44	15 45	50 37	16 2	51 29	16 20	40	8
20	45 22	14 19	46 14	14 37	47 6	14 54	47 59	15 11	48 51	15 29	49 43	15 46	50 36	16 3	51 28	16 21	41	8
22	45 21	14 20	46 14	14 38	47 6	14 55	47 58	15 12	48 51	15 30	49 43	15 47	50 35	16 4	51 27	16 22	42	8
24	45 21	14 21	46 13	14 38	47 5	14 56	47 57	15 13	48 50	15 31	49 42	15 48	50 34	16 5	51 27	16 23	43	8
26	45 20	14 22	46 12	14 39	47 4	14 57	47 57	15 14	48 49	15 32	49 41	15 49	50 33	16 6	51 26	16 24	44	8
28	45 19	14 23	46 11	14 40	47 3	14 58	47 56	15 15	48 48	15 33	49 40	15 50	50 32	16 7	51 25	16 25	45	8
30	45 18	14 24	46 10	14 41	47 3	14 59	47 55	15 16	48 47	15 34	49 39	15 51	50 32	16 8	51 24	16 26	46	8
32	45 17	14 25	46 10	14 42	47 2	15 0	47 54	15 17	48 46	15 35	49 38	15 52	50 31	16 10	51 23	16 27	47	8
34	45 17	14 26	46 9	14 43	47 1	15 1	47 53	15 18	48 45	15 36	49 38	15 53	50 30	16 11	51 22	16 28	48	8
36	45 16	14 27	46 8	14 44	47 0	15 2	47 52	15 19	48 45	15 37	49 37	15 54	50 29	16 12	51 21	16 29	49	8
38	45 15	14 28	46 7	14 45	46 59	15 3	47 51	15 20	48 44	15 38	49 36	15 55	50 28	16 13	51 20	16 30	50	8
40	45 14	14 29	46 6	14 46	46 58	15 4	47 51	15 21	48 43	15 39	49 35	15 56	50 27	16 14	51 19	16 31	51	8
42	45 13	14 30	46 5	14 47	46 58	15 5	47 50	15 22	48 42	15 40	49 34	15 57	50 26	16 15	51 18	16 32	52	8
44	45 13	14 30	46 5	14 48	46 57	15 6	47 49	15 23	48 41	15 41	49 33	15 58	50 25	16 16	51 17	16 33	53	8
46	45 12	14 31	46 4	14 49	46 56	15 7	47 48	15 24	48 40	15 42	49 32	15 59	50 24	16 17	51 16	16 34	54	8
48	45 11	14 32	46 3	14 50	46 55	15 7	47 47	15 25	48 39	15 43	49 31	16 0	50 23	16 18	51 15	16 35	55	8
50	45 10	14 33	46 2	14 51	46 54	15 8	47 46	15 26	48 38	15 44	49 30	16 1	50 23	16 19	51 14	16 36	56	8
52	45 9	14 34	46 1	14 52	46 53	15 9	47 45	15 27	48 38	15 45	49 30	16 2	50 22	16 20	51 14	16 37	57	8
54	45 8	14 35	46 0	14 53	46 53	15 10	47 45	15 28	48 37	15 46	49 29	16 3	50 21	16 21	51 13	16 39	58	8
56	45 7	14 36	46 0	14 54	46 52	15 11	47 44	15 29	48 36	15 47	49 28	16 4	50 20	16 22	51 12	16 40	59	8
58	45 7	14 37	45 59	14 55	46 51	15 12	47 43	15 30	48 35	15 48	49 27	16 5	50 19	16 23	51 11	16 41	60	8

(30° and 31°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
30°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0	45	6	14	38	45	58	14	56	46	50	15	13	47	42	15	31	48	34
2	45	5	14	39	45	57	14	57	46	49	15	14	47	41	15	32	48	33
4	45	4	14	40	45	56	14	58	46	48	15	15	47	40	15	33	48	32
6	45	4	14	41	45	56	14	58	46	48	15	16	47	40	15	34	48	31
8	45	3	14	42	45	55	14	59	46	47	15	17	47	39	15	35	48	31
10	45	2	14	43	45	54	15	0	46	46	15	18	47	38	15	36	48	30
12	45	1	14	44	45	53	15	1	46	45	15	19	47	37	15	37	48	29
14	45	0	14	44	45	52	15	2	46	44	15	20	47	36	15	38	48	28
16	45	0	14	45	45	51	15	3	46	43	15	21	47	35	15	39	48	27
18	44	59	14	46	45	50	15	4	46	43	15	22	47	34	15	40	48	26
20	44	58	14	47	45	50	15	5	46	42	15	23	47	33	15	41	48	25
22	44	57	14	48	45	49	15	6	46	41	15	24	47	33	15	42	48	24
24	44	56	14	49	45	48	15	7	46	40	15	25	47	32	15	43	48	23
26	44	56	14	50	45	47	15	8	46	39	15	26	47	31	15	44	48	23
28	44	55	14	51	45	46	15	9	46	38	15	27	47	30	15	45	48	22
30	44	54	14	52	45	45	15	10	46	37	15	28	47	29	15	46	48	21
32	44	53	14	53	45	45	15	11	46	37	15	29	47	28	15	47	48	20
34	44	52	14	54	45	44	15	12	46	36	15	30	47	27	15	48	48	19
36	44	51	14	55	45	43	15	13	46	35	15	31	47	26	15	49	48	18
38	44	51	14	56	45	42	15	14	46	34	15	32	47	26	15	50	48	17
40	44	50	14	56	45	41	15	15	46	33	15	33	47	25	15	51	48	16
42	44	49	14	57	45	40	15	16	46	32	15	34	47	24	15	52	48	15
44	44	48	14	58	45	40	15	16	46	31	15	35	47	23	15	53	48	14
46	44	47	14	59	45	39	15	17	46	30	15	35	47	22	15	54	48	14
48	44	46	15	0	45	38	15	18	46	30	15	36	47	21	15	55	48	13
50	44	46	15	1	45	37	15	19	46	29	15	37	47	20	15	56	48	12
52	44	45	15	2	45	36	15	20	46	28	15	38	47	19	15	57	48	11
54	44	44	15	3	45	35	15	21	46	27	15	39	47	18	15	57	48	10
56	44	43	15	4	45	34	15	22	46	26	15	40	47	17	15	58	48	9
58	44	42	15	5	45	34	15	23	46	25	15	41	47	17	15	59	48	8
31°	54		55		56		57		58		59		60		61			
0	44	41	15	6	45	33	15	24	46	24	15	42	47	16	16	0	48	59
2	44	41	15	7	45	32	15	25	46	23	15	43	47	15	16	1	48	58
4	44	40	15	8	45	31	15	26	46	23	15	44	47	14	16	2	48	57
6	44	39	15	9	45	30	15	27	46	22	15	45	47	13	16	3	48	56
8	44	38	15	9	45	29	15	28	46	21	15	46	47	12	16	4	48	55
10	44	37	15	10	45	28	15	29	46	20	15	47	47	11	16	5	48	54
12	44	36	15	11	45	28	15	30	46	19	15	48	47	10	16	6	48	53
14	44	35	15	12	45	27	15	31	46	18	15	49	47	9	16	7	48	52
16	44	35	15	13	45	26	15	32	46	17	15	50	47	8	16	8	48	51
18	44	34	15	14	45	25	15	33	46	16	15	51	47	7	16	9	47	50
20	44	33	15	15	45	24	15	34	46	15	15	52	47	6	16	10	47	50
22	44	32	15	16	45	23	15	34	46	14	15	53	47	5	16	11	47	50
24	44	31	15	17	45	22	15	35	46	14	15	54	47	4	16	12	47	50
26	44	30	15	18	45	21	15	36	46	13	15	55	47	3	16	13	47	50
28	44	30	15	19	45	20	15	37	46	12	15	56	47	2	16	14	47	50
30	44	29	15	20	45	20	15	38	46	11	15	57	47	1	16	15	47	50
32	44	28	15	21	45	19	15	39	46	10	15	57	47	0	16	16	47	50
34	44	27	15	21	45	18	15	40	46	9	15	58	47	0	16	17	47	51
36	44	26	15	22	45	17	15	41	46	8	15	59	46	59	16	18	47	50
38	44	25	15	23	45	16	15	42	46	7	15	0	46	58	16	19	47	49
40	44	24	15	24	45	15	15	43	46	6	15	1	46	57	16	20	47	48
42	44	23	15	25	45	14	15	44	46	5	15	2	46	57	16	21	47	48
44	44	22	15	26	45	13	15	45	46	4	15	3	46	56	16	22	47	47
46	44	22	15	27	45	12	15	46	46	3	15	4	46	55	16	23	47	46
48	44	21	15	28	45	12	15	46	46	2	15	5	46	54	16	24	47	45
50	44	21	15	29	45	11	15	47	46	1	15	6	46	53	16	25	47	44
52	44	20	15	29	45	11	15	47	46	0	15	7	46	52	16	26	47	43
54	44	18	15	31	45	9	15	49	46	0	16	8	46	51	16	27	47	42
56	44	17	15	31	45	8	15	50	45	59	16	9	46	50	16	28	47	41
58	44	16	15	32	45	7	15	51	45	58	16	10	46	49	16	29	47	40

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (32° and 33°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	Cor	A
32°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"	"
0'	44 15	15 33	45 6	15 52	45 57	16 11	46 48	16 29	47 39	16 48	48 30	17 7	49 21	17 26	50 12	17 44	1	1	0
2	44 14	15 34	45 5	15 53	45 56	16 12	46 47	16 30	47 38	16 49	48 29	17 8	49 20	17 27	50 11	17 45	2	2	1
4	44 14	15 35	45 4	15 54	45 55	16 13	46 46	16 31	47 37	16 50	48 28	17 9	49 19	17 28	50 10	17 46	3	3	1
6	44 13	15 36	45 3	15 55	45 54	16 14	46 45	16 32	47 36	16 51	48 27	17 10	49 18	17 29	50 9	17 47	4	4	2
8	44 12	15 37	45 2	15 56	45 53	16 15	46 44	16 33	47 35	16 52	48 26	17 11	49 17	17 30	50 8	17 48	5	5	2
10	44 11	15 38	45 1	15 57	45 52	16 15	46 43	16 34	47 34	16 53	48 25	17 12	49 16	17 31	50 7	17 50	6	6	3
12	44 10	15 39	45 0	15 58	45 51	16 16	46 42	16 35	47 33	16 54	48 24	17 13	49 15	17 32	50 6	17 51	7	7	3
14	44 9	15 40	45 0	15 59	45 51	16 17	46 41	16 36	47 32	16 55	48 23	17 14	49 14	17 33	50 5	17 52	8	8	3
16	44 8	15 41	44 59	15 59	45 50	16 18	46 40	16 37	47 31	16 56	48 22	17 15	49 13	17 34	50 4	17 53	9	9	3
18	44 7	15 41	44 58	16 0	45 49	16 19	46 39	16 38	47 30	16 57	48 21	17 16	49 12	17 35	50 3	17 54	10	10	4
20	44 6	15 42	44 57	16 1	45 48	16 20	46 38	16 39	47 29	16 58	48 20	17 17	49 11	17 36	50 2	17 55	11	11	4
22	44 6	15 43	44 56	16 2	45 47	16 21	46 38	16 40	47 28	16 59	48 19	17 18	49 10	17 37	50 1	17 56	12	12	4
24	44 5	15 44	44 55	16 3	45 46	16 22	46 37	16 41	47 27	17 0	48 18	17 19	49 9	17 38	49 59	17 57	13	13	5
26	44 4	15 45	44 54	16 4	45 45	16 23	46 36	16 42	47 26	17 1	48 17	17 20	49 8	17 39	49 58	17 58	14	14	5
28	44 3	15 46	44 53	16 5	45 44	16 24	46 35	16 43	47 25	17 2	48 16	17 21	49 7	17 40	49 57	17 59	15	15	5
30	44 2	15 47	44 52	16 6	45 43	16 25	46 34	16 44	47 24	17 3	48 15	17 22	49 6	17 41	49 56	18 0	16	16	5
32	44 1	15 48	44 51	16 7	45 42	16 26	46 33	16 45	47 23	17 4	48 14	17 23	49 5	17 42	49 55	18 1	17	17	5
34	44 0	15 49	44 51	16 8	45 41	16 27	46 32	16 46	47 23	17 5	48 13	17 24	49 4	17 43	49 54	18 2	18	18	5
36	43 59	15 50	44 50	16 9	45 40	16 28	46 31	16 47	47 22	17 6	48 12	17 25	49 3	17 44	49 53	18 3	19	19	5
38	43 58	15 51	44 49	16 10	45 40	16 29	46 30	16 48	47 21	17 7	48 11	17 26	49 2	17 45	49 52	18 4	20	20	5
40	43 57	15 51	44 48	16 11	45 39	16 30	46 29	16 49	47 20	17 8	48 10	17 27	49 1	17 46	49 51	18 5	21	21	5
42	43 57	15 52	44 47	16 12	45 38	16 31	46 28	16 50	47 19	17 9	48 9	17 28	49 0	17 47	49 50	18 6	22	22	5
44	43 56	15 53	44 46	16 12	45 37	16 31	46 27	16 51	47 18	17 10	48 8	17 29	48 59	17 48	49 49	18 7	23	23	5
46	43 55	15 54	44 45	16 13	45 36	16 32	46 26	16 52	47 17	17 11	48 7	17 30	48 58	17 49	49 48	18 8	24	24	5
48	43 54	15 55	44 44	16 14	45 35	16 33	46 25	16 53	47 16	17 12	48 6	17 31	48 57	17 50	49 47	18 9	25	25	5
50	43 53	15 56	44 43	16 15	45 34	16 34	46 24	16 53	47 15	17 13	48 5	17 32	48 56	17 51	49 46	18 10	26	26	5
52	43 52	15 57	44 43	16 16	45 33	16 35	46 23	16 54	47 14	17 14	48 4	17 33	48 55	17 52	49 45	18 11	27	27	5
54	43 51	15 58	44 42	16 17	45 32	16 36	46 22	16 55	47 13	17 15	48 3	17 34	48 54	17 53	49 44	18 12	28	28	5
56	43 50	15 59	44 41	16 18	45 31	16 37	46 21	16 56	47 12	17 16	48 2	17 35	48 53	17 54	49 43	18 13	29	29	5
58	43 49	16 0	44 40	16 19	45 30	16 38	46 20	16 57	47 11	17 17	48 1	17 36	48 52	17 55	49 42	18 14	30	30	5
33°	54'		55'		56'		57'		58'		59'		60'		61'		Alt.	Cor	A
0'	43 48	16 1	44 39	16 20	45 29	16 39	46 19	16 58	47 10	17 17	48 0	17 37	48 51	17 56	49 41	18 15	41	41	5
2	43 48	16 1	44 38	16 21	45 28	16 40	46 19	16 59	47 9	17 18	47 59	17 38	48 50	17 57	49 40	18 16	42	42	5
4	43 47	16 2	44 37	16 22	45 27	16 41	46 18	17 0	47 8	17 19	47 58	17 39	48 49	17 58	49 39	18 17	43	43	5
6	43 46	16 3	44 36	16 23	45 26	16 42	46 17	17 1	47 7	17 20	47 57	17 40	48 47	17 59	49 38	18 18	44	44	5
8	43 45	16 4	44 35	16 23	45 25	16 43	46 16	17 2	47 6	17 21	47 56	17 41	48 46	18 0	49 37	18 19	45	45	5
10	43 44	16 5	44 34	16 24	45 24	16 44	46 15	17 3	47 5	17 22	47 55	17 42	48 45	18 1	49 36	18 20	46	46	5
12	43 43	16 6	44 33	16 25	45 23	16 45	46 14	17 4	47 4	17 23	47 54	17 43	48 44	18 2	49 35	18 21	47	47	5
14	43 42	16 7	44 32	16 26	45 22	16 46	46 13	17 5	47 3	17 24	47 53	17 44	48 43	18 3	49 34	18 22	48	48	5
16	43 41	16 8	44 31	16 27	45 22	16 47	46 12	17 6	47 2	17 25	47 52	17 45	48 42	18 4	49 32	18 23	49	49	5
18	43 40	16 9	44 30	16 28	45 21	16 48	46 11	17 7	47 1	17 26	47 51	17 46	48 41	18 5	49 31	18 24	50	50	5
20	43 39	16 10	44 29	16 29	45 20	16 49	46 10	17 8	47 0	17 27	47 50	17 46	48 40	18 6	49 30	18 25	51	51	5
22	43 38	16 10	44 29	16 30	45 19	16 49	46 9	17 9	46 59	17 28	47 49	17 47	48 39	18 7	49 29	18 26	52	52	5
24	43 37	16 11	44 28	16 31	45 18	16 50	46 8	17 10	46 58	17 29	47 48	17 48	48 38	18 8	49 28	18 27	53	53	5
26	43 37	16 12	44 27	16 32	45 17	16 51	46 7	17 11	46 57	17 30	47 47	17 49	48 37	18 9	49 27	18 28	54	54	5
28	43 36	16 13	44 26	16 33	45 16	16 52	46 6	17 12	46 56	17 31	47 46	17 50	48 36	18 10	49 26	18 29	55	55	5
30	43 35	16 14	44 25	16 34	45 15	16 53	46 5	17 13	46 55	17 32	47 45	17 51	48 35	18 11	49 25	18 30	56	56	5
32	43 34	16 15	44 24	16 34	45 14	16 54	46 4	17 13	46 54	17 33	47 44	17 52	48 34	18 12	49 24	18 31	57	57	5
34	43 33	16 16	44 23	16 35	45 13	16 55	46 3	17 14	46 53	17 34	47 43	17 53	48 33	18 13	49 23	18 32	58	58	5
36	43 32	16 17	44 22	16 36	45 12	16 56	46 2	17 15	46 52	17 35	47 42	17 54	48 32	18 14	49 22	18 33	59	59	5
38	43 31	16 18	44 21	16 37	45 11	16 57	46 1	17 16	46 51	17 36	47 41	17 55	48 31	18 15	49 21	18 34	60	60	5
40	43 30	16 19	44 20	16 38	45 10	16 58	46 0	17 17	46 50	17 37	47 40	17 56	48 30	18 16	49 20	18 35	61	61	5
42	43 29	16 19	44 19	16 39	45 9	16 59	45 59	17 18	46 49	17 38	47 39	17 57	48 29	18 17	49 19	18 36	62	62	5
44	43 28	16 20	44 18	16 40	45 8	17 0	45 58	17 19	46 48	17 39	47 38	17 58	48 28	18 18	49 18	18 37	63	63	5
46	43 27	16 21	44 17	16 41	45 7	17 0	45 57	17 20	46 47	17 40	47 37	17 59	48 27	18 19	49 17	18 38	64	64	5
48	43 26	16 22	44 16	16 42	45 6	17 1	45 56	17 21	46 46	17 41	47 36	18 0	48 26	18 20	49 15	18 39	65	65	5
50	43 25	16 23	44 15	16 43	45 5	17 2	45 55	17 22	46 45	17 42	47 35	18 1	48 24	18 21	49 14	18 40	66	66	5
52	43 24	16 24	44 14	16 44	45 4	17 3	45 54	17 23	46 44	17 43	47 34	18 2	48 23	18 22	49 13	18 42	67	67	5
54	43 24	16 25	44 13	16 45	45 3	17 4	45 53	17 24	46 43	17 44	47 33	18 3	48 22	18 23	49 12	18 43	68	68	5
56	43 23	16 26	44 12	16 46	45 2	17 5	45 52	17 25	46 42	17 45	47 32	18 4	48 21	18 24	49 11	18 44	69	69	5
58	43 22	16 27	44 12	16 46	45 1	17 6	45 51	17 26	46 41	17 46	47 31	18 5	48 20	18 25	49 10	18 45	70	70	5

(34° and 35°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									"	A
34°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	1	0
0'	43 21	16 28 44	11	16 47	45 0	17 7 45	50	17 27	46 40	17 46	47 30	18 6 48	19 18 26	49	9	18 46	1	0
2	43 20	16 28 44	10	16 48	44 59	17 8 45	49	17 28	46 39	17 47	47 29	18 7 48	18 27 49	8	18 47	4	3	
4	43 19	16 29 44	9	16 49	44 58	17 9 45	48	17 29	46 38	17 48	47 27	18 8 48	17 18 28	49	7	18 48	5	4
6	43 18	16 30 44	8	16 50	44 57	17 10 45	47	17 30	46 37	17 49	47 26	18 9 48	16 18 29	49	6	18 49	6	5
8	43 17	16 31 44	7	16 51	44 56	17 11 45	46	17 30	46 36	17 50	47 25	18 10 48	15 18 30	49	5	18 50	7	6
10	43 16	16 32 44	6	16 52	44 55	17 12 45	45	17 31	46 35	17 51	47 24	18 11 48	14 18 31	49	4	18 51	8	7
12	43 15	16 33 44	5	16 53	44 54	17 13 45	44	17 32	46 34	17 52	47 23	18 12 48	13 18 32	49	3	18 52	9	8
14	43 14	16 34 44	4	16 54	44 53	17 13 45	43	17 33	46 33	17 53	47 22	18 13 48	12 18 33	49	2	18 53	10	9
16	43 13	16 35 44	3	16 55	44 52	17 14 45	42	17 34	46 31	17 54	47 21	18 14 48	11 18 34	49	1	18 54	11	10
18	43 12	16 36 44	2	16 55	44 51	17 15 45	41	17 35	46 30	17 55	47 20	18 15 48	10 18 35	48	59	18 55	12	11
20	43 11	16 36 44	1	16 56	44 50	17 16 45	40	17 36	46 29	17 56	47 19	18 16 48	9 18 36	48	58	18 56	13	12
22	43 10	16 37 44	0	16 57	44 49	17 17 45	39	17 37	46 28	17 57	47 18	18 17 48	7 18 37	48	57	18 57	14	13
24	43 9	16 38 43 59		16 58	44 48	17 18 45	38	17 38	46 27	17 58	47 17	18 18 48	6 18 38	48	56	18 58	15	14
26	43 8	16 39 43 58		17 0	44 47	17 19 45	37	17 39	46 26	17 59	47 16	18 19 48	5 18 39	48	55	18 59	16	15
28	43 7	16 40 43 57		17 1	44 46	17 20 45	36	17 40	46 25	18 0	47 15	18 20 48	4 18 40	48	54	19 0	17	16
30	43 6	16 41 43 56		17 2	44 45	17 21 45	35	17 41	46 24	18 1	47 14	18 21 48	3 18 41	48	53	19 1	18	17
32	43 5	16 42 43 55		17 3	44 44	17 22 45	34	17 42	46 23	18 2	47 13	18 22 48	2 18 42	48	51	19 2	19	18
34	43 4	16 43 43 54		17 4	44 43	17 23 45	33	17 43	46 22	18 3	47 12	18 23 48	1 18 43	48	50	19 3	20	19
36	43 3	16 44 43 53		17 4	44 42	17 24 45	32	17 44	46 21	18 4	47 10	18 24 48	0 18 44	48	49	19 4	21	20
38	43 2	16 44 43 52		17 5	44 41	17 25 45	31	17 44	46 20	18 5	47 9	18 25 47	59 18 45	48	48	19 5	22	21
40	43 1	16 45 43 51		17 5	44 40	17 25 45	29	17 45	46 19	18 5	47 8	18 25 47	58 18 45	48	47	19 6	23	22
42	43 0	16 46 43 50		17 6	44 39	17 26 45	28	17 46	46 18	18 6	47 7	18 26 47	57 18 46	48	46	19 7	24	23
44	42 59	16 47 43 49		17 7	44 38	17 27 45	27	17 47	46 17	18 7	47 6	18 27 47	56 18 47	48	45	19 8	25	24
46	42 59	16 48 43 48		17 8	44 37	17 28 45	26	17 48	46 16	18 8	47 5	18 28 47	55 18 48	48	44	19 9	26	25
48	42 58	16 49 43 47		17 9	44 36	17 29 45	25	17 49	46 15	18 9	47 4	18 29 47	54 18 49	48	43	19 10	27	26
50	42 57	16 50 43 46		17 10	44 35	17 30 45	24	17 50	46 14	18 10	47 3	18 30 47	53 18 50	48	41	19 11	28	27
52	42 56	16 51 43 45		17 11	44 34	17 31 45	23	17 51	46 13	18 11	47 2	18 31 47	52 18 51	48	40	19 12	29	28
54	42 55	16 52 43 44		17 12	44 33	17 32 45	22	17 52	46 12	18 12	47 1	18 32 47	50 18 52	48	39	19 13	30	29
56	42 54	16 52 43 43		17 13	44 32	17 33 45	21	17 53	46 11	18 13	47 0	18 33 47	49 18 53	48	38	19 14	31	30
58	42 53	16 53 43 42		17 13	44 31	17 34 45	20	17 54	46 10	18 14	46 59	18 34 47	48 18 54	48	37	19 15	32	31
35°	54'	55'	56'	57'	58'	59'	60'	61'									40	33
0'	42 52	16 54	43 41	17 14	44 30	17 35 45	19	17 55	46 8	18 15	46 58	18 35 47	47 18 55	48	36	19 16	41	33
2	42 51	16 55	43 40	17 15	44 29	17 36 45	18	17 56	46 7	18 16	46 57	18 36 47	46 18 56	48	35	19 17	42	34
4	42 50	16 56	43 39	17 16	44 28	17 36 45	17	17 57	46 6	18 17	46 55	18 37 47	45 18 57	48	34	19 18	43	35
6	42 49	16 57	43 38	17 17	44 27	17 37 45	16	17 58	46 5	18 18	46 54	18 38 47	44 18 58	48	33	19 19	44	36
8	42 48	16 58	43 37	17 18	44 26	17 38 45	15	17 59	46 4	18 19	46 53	18 39 47	43 18 59	48	31	19 20	45	37
10	42 47	16 59	43 36	17 19	44 25	17 39 45	14	17 59	46 3	18 20	46 52	18 40 47	42 19 0	48	30	19 21	46	38
12	42 46	16 59	43 35	17 20	44 24	17 40 45	13	18 0	46 2	18 21	46 51	18 41 47	40 19 1	48	29	19 22	47	39
14	42 45	17 0	43 34	17 21	44 23	17 41 45	12	18 1	46 1	18 22	46 50	18 42 47	39 19 2	48	28	19 23	50	40
16	42 44	17 1	43 33	17 22	44 22	17 42 45	11	18 2	46 0	18 23	46 49	18 43 47	38 19 3	48	27	19 24	51	41
18	42 43	17 2	43 32	17 22	44 21	17 43 45	10	18 3	45 59	18 23	46 48	18 44 47	37 19 4	48	26	19 25	52	42
20	42 42	17 3	43 31	17 23	44 20	17 44 45	9	18 4	45 58	18 24 46	47 18 45	47 36 19	5 48 25	19 25	54	41	18	53
22	42 41	17 4	43 30	17 24	44 19	17 45 45	8	18 5	45 57	18 25 46	47 18 46	47 34 19	6 48 23	19 26	55	40	19	54
24	42 40	17 5	43 29	17 25	44 18	17 46 45	7	18 6	45 56	18 26 46	47 18 47	47 33 19	7 48 22	19 27	56	39	20	55
26	42 39	17 6	43 28	17 26	44 17	17 46 45	6	18 7	45 54	18 27 46	47 18 48	47 32 19	8 48 21	19 28	57	38	21	56
28	42 38	17 6	43 27	17 27	44 16	17 47 45	4	18 8	45 53	18 28 46	47 18 49	47 31 19	9 48 20	19 29	58	37	22	57
30	42 37	17 7	43 26	17 28	44 15	17 48 45	3	18 9	45 52	18 29 46	47 18 50	47 30 19	10 48 19	19 30	59	36	23	58
32	42 36	17 8	43 25	17 29	44 14	17 49 45	2	18 10	45 51	18 30 46	47 18 50	47 29 19	11 48 18	19 31	60	35	24	59
34	42 35	17 9	43 24	17 30	44 12	17 50 45	1	18 11	45 50	18 31 46	47 18 51	47 28 19	12 48 17	19 32	61	34	25	60
36	42 34	17 10	43 23	17 30	44 11	17 51 45	0	18 11	45 49	18 32 46	47 18 52	47 27 19	13 48 16	19 33	62	33	26	61
38	42 33	17 11	43 22	17 31	44 10	17 52 45	59	18 12	45 48	18 33 46	47 18 53	47 26 19	14 48 15	19 34	63	32	27	62
40	42 32	17 12	43 21	17 32 44	9	17 53 44	58	18 13	45 47	18 34 46	47 18 54	47 24 19	15 48 14	19 35	64	31	28	63
42	42 31	17 13	43 20	17 33 44	8	17 54 44	57	18 14	45 46	18 35 46	47 18 55	47 23 19	16 48 13	19 36	65	30	29	64
44	42 30	17 13	43 19	17 34 44	7	17 55 44	56	18 15	45 45	18 36 46	47 18 56	47 22 19	17 48 12	19 37	66	29	30	65
46	42 29	17 14	43 18	17 35 44	6	17 56 44	55	18 16	45 44	18 37 46	47 18 57	47 21 19	18 48 11	19 38	67	28	31	66
48	42 28	17 15	43 17	17 36 44	5	17 56 44	54	18 17	45 43	18 38 46	47 18 58	47 20 19	19 48 10	19 39	68	27	32	67
50	42 27	17 16	43 16	17 37 44	4	17 57 44	53	18 18	45 42	18 39 46	47 18 59	47 19 19	20 48 9	19 40	69	26	33	68
52	42 26	17 17	43 15	17 38 44	3	17 58 44	52	18 19	45 41	18 39 46	47 18 59	47 18 19	21 48 8	19 41	70	25	34	69
54	42 25	17 18	43 14	17 38 44	2	17 59 44	51	18 20	45 39	18 40 46	47 18 59	47 17 19	22 48 7	19 42	71	24	35	70
56	42 24	17 19	43 13	17 39 44	1	18 0	44 50	18 21	45 38	18 41 46	47 18 59	47 16 19	23 48 6	19 43	72	23	36	71
58	42 23	17 20	43 12	17 40 44	0	18 1	44 49	18 22	45 37	18 42 46	47 18 59	47 15 19	24 48 5	19 44	73	22	37	72

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (36° and 37°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A
	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°
36°																		
0'	42 22	17 20	43 10	17 41	43 59	18 2	44 48	18 23	45 36	18 43	46 25	19 4	47 13	19 25	48 2	19 45	1	1 0
2	42 21	17 21	43 9	17 42	43 58	18 3	44 47	18 24	45 35	18 44	46 24	19 5	47 12	19 26	48 1	19 46	2	2 1
4	42 20	17 22	43 8	17 43	43 57	18 4	44 45	18 24	45 34	18 45	46 23	19 6	47 11	19 27	48 0	19 47	3	3 1
6	42 19	17 23	43 7	17 44	43 56	18 5	44 44	18 25	45 33	18 46	46 21	19 7	47 10	19 27	47 58	19 48	4	4 1
8	42 18	17 24	43 6	17 45	43 55	18 6	44 43	18 26	45 32	18 47	46 20	19 8	47 9	19 28	47 57	19 49	5	5 1
10	42 17	17 25	43 5	17 46	43 54	18 7	44 42	18 27	45 31	18 48	46 19	19 9	47 8	19 29	47 56	19 50	6	6 1
12	42 16	17 26	43 4	17 46	43 53	18 8	44 41	18 28	45 30	18 49	46 18	19 10	47 6	19 30	47 55	19 51	7	7 1
14	42 15	17 27	43 3	17 47	43 52	18 9	44 40	18 29	45 28	18 50	46 17	19 10	47 5	19 31	47 54	19 52	8	8 1
16	42 14	17 27	43 2	17 48	43 51	18 9	44 39	18 30	45 27	18 51	46 16	19 11	47 4	19 32	47 53	19 53	9	9 1
18	42 13	17 28	43 1	17 49	43 49	18 10	44 38	18 31	45 26	18 52	46 15	19 12	47 3	19 33	47 51	19 54	10	10 1
20	42 12	17 29	43 0	17 50	43 48	18 11	44 37	18 32	45 25	18 52	46 13	19 13	47 2	19 34	47 50	19 55	11	11 1
22	42 11	17 30	42 59	17 51	43 47	18 12	44 36	18 33	45 24	18 53	46 12	19 14	47 1	19 35	47 49	19 56	12	12 1
24	42 10	17 31	42 58	17 52	43 46	18 13	44 35	18 34	45 23	18 54	46 11	19 15	46 59	19 36	47 48	19 57	13	13 1
26	42 9	17 32	42 57	17 53	43 45	18 14	44 34	18 34	45 22	18 55	46 10	19 16	46 58	19 37	47 47	19 58	14	14 1
28	42 8	17 33	42 56	17 54	43 44	18 14	44 32	18 35	45 21	18 56	46 9	19 17	46 57	19 38	47 46	19 59	15	15 1
30	42 7	17 33	42 55	17 54	43 43	18 15	44 31	18 36	45 20	18 57	46 8	19 18	46 56	19 39	47 44	20 1	16	16 1
32	42 6	17 34	42 54	17 55	43 42	18 16	44 30	18 37	45 18	18 58	46 7	19 19	46 55	19 40	47 43	20 2	17	17 1
34	42 4	17 35	42 53	17 56	43 41	18 17	44 29	18 38	45 17	18 59	46 6	19 20	46 54	19 41	47 42	20 3	18	18 1
36	42 3	17 36	42 52	17 57	43 40	18 18	44 28	18 39	45 16	19 0	46 5	19 21	46 53	19 42	47 41	20 4	19	19 1
38	42 2	17 37	42 51	17 58	43 39	18 19	44 27	18 40	45 15	19 1	46 4	19 22	46 51	19 43	47 40	20 5	20	20 1
40	42 1	17 38	42 50	17 59	43 38	18 20	44 26	18 41	45 14	19 2	46 3	19 23	46 50	19 45	47 38	20 6	21	21 1
42	42 0	17 39	42 49	18 0	43 37	18 21	44 25	18 42	45 13	19 3	46 2	19 24	46 49	19 46	47 37	20 7	22	22 1
44	41 59	17 40	42 48	18 1	43 36	18 22	44 24	18 43	45 12	19 4	46 1	19 25	46 48	19 47	47 36	20 8	23	23 1
46	41 58	17 40	42 46	18 2	43 35	18 23	44 23	18 44	45 11	19 5	45 59	19 26	46 47	19 47	47 35	20 9	24	24 1
48	41 57	17 41	42 45	18 3	43 33	18 23	44 22	18 44	45 10	19 6	45 58	19 27	46 46	19 48	47 34	20 10	25	25 1
50	41 56	17 42	42 44	18 3	43 32	18 24	44 20	18 45	45 8	19 7	45 57	19 28	46 45	19 49	47 33	20 11	26	26 1
52	41 55	17 43	42 43	18 4	43 31	18 25	44 19	18 46	45 7	19 8	45 55	19 28	46 45	19 50	47 31	20 11	27	27 1
54	41 54	17 44	42 42	18 5	43 30	18 26	44 18	18 47	45 6	19 8	45 54	19 29	46 42	19 51	47 30	20 12	28	28 1
56	41 53	17 45	42 41	18 6	43 29	18 27	44 17	18 48	45 5	19 9	45 53	19 30	46 41	19 52	47 29	20 13	29	29 1
58	41 52	17 46	42 40	18 7	43 28	18 28	44 16	18 49	45 4	19 10	45 52	19 31	46 40	19 53	47 28	20 14	30	30 1
37°																		
0'	41 51	17 46	42 39	18 8	43 27	18 29	44 15	18 50	45 3	19 11	45 51	19 32	46 39	19 53	47 27	20 15	31	31 1
2	41 50	17 47	42 38	18 9	43 26	18 30	44 14	18 51	45 2	19 12	45 50	19 33	46 38	19 54	47 26	20 16	32	32 1
4	41 49	17 48	42 37	18 9	43 25	18 31	44 13	18 52	45 1	19 13	45 49	19 34	46 37	19 55	47 24	20 17	33	33 1
6	41 48	17 49	42 36	18 10	43 24	18 31	44 12	18 53	45 0	19 14	45 47	19 35	46 35	19 56	47 23	20 17	34	34 1
8	41 47	17 50	42 35	18 11	43 23	18 32	44 11	18 54	44 58	19 15	45 46	19 36	46 34	19 57	47 22	20 18	35	35 1
10	41 46	17 51	42 34	18 12	43 22	18 33	44 9	18 54	44 57	19 16	45 45	19 37	46 33	19 58	47 21	20 19	36	36 1
12	41 45	17 52	42 33	18 13	43 20	18 34	44 8	18 55	44 56	19 17	45 44	19 38	46 32	19 59	47 20	20 20	37	37 1
14	41 44	17 53	42 32	18 14	43 19	18 35	44 7	18 56	44 55	19 17	45 43	19 39	46 31	20 0	47 18	20 21	38	38 1
16	41 43	17 53	42 30	18 15	43 18	18 36	44 6	18 57	44 54	19 18	45 42	19 40	46 29	20 1	47 17	20 22	39	39 1
18	41 42	17 54	42 29	18 15	43 17	18 37	44 5	18 58	44 53	19 19	45 40	19 41	46 28	20 2	47 16	20 23	40	40 1
20	41 41	17 55	42 28	18 16	43 16	18 38	44 4	18 59	44 51	19 20	45 39	19 41	46 27	20 3	47 15	20 24	41	41 1
22	41 40	17 56	42 27	18 17	43 15	18 38	44 3	19 0	44 50	19 21	45 38	19 42	46 26	20 4	47 13	20 25	42	42 1
24	41 38	17 57	42 26	18 18	43 14	18 39	44 2	19 1	44 49	19 22	45 37	19 43	46 25	20 5	47 12	20 26	43	43 1
26	41 37	17 58	42 25	18 19	43 13	18 40	44 1	19 2	44 48	19 23	45 36	19 44	46 23	20 6	47 11	20 27	44	44 1
28	41 36	17 58	42 24	18 20	43 12	18 41	43 59	19 3	44 47	19 24	45 35	19 45	46 22	20 7	47 10	20 28	45	45 1
30	41 35	17 59	42 23	18 21	43 11	18 42	43 58	19 3	44 46	19 25	45 33	19 46	46 21	20 8	47 9	20 29	46	46 1
32	41 34	18 0	42 22	18 22	43 9	18 43	43 57	19 4	44 45	19 26	45 32	19 47	46 20	20 8	47 7	20 30	47	47 1
34	41 33	18 1	42 21	18 22	43 8	18 44	43 56	19 5	44 44	19 27	45 31	19 48	46 19	20 9	47 6	20 31	48	48 1
36	41 32	18 2	42 20	18 23	43 7	18 45	43 55	19 6	44 42	19 28	45 30	19 49	46 18	20 10	47 5	20 32	49	49 1
38	41 31	18 3	42 19	18 24	43 6	18 46	43 54	19 7	44 41	19 29	45 29	19 50	46 16	20 11	47 4	20 33	50	50 1
40	41 30	18 3	42 18	18 25	43 5	18 46	43 53	19 8	44 40	19 29	45 28	19 51	46 15	20 12	47 3	20 34	51	51 1
42	41 29	18 4	42 17	18 26	43 4	18 47	43 51	19 9	44 39	19 30	45 27	19 52	46 14	20 13	47 2	20 35	52	52 1
44	41 28	18 5	42 15	18 28	43 3	18 48	43 50	19 10	44 38	19 31	45 25	19 53	46 13	20 14	47 0	20 36	53	53 1
46	41 27	18 6	42 14	18 29	43 2	18 49	43 49	19 11	44 37	19 32	45 24	19 54	46 12	20 15	46 59	20 37	54	54 1
48	41 26	18 7	42 13	18 30	43 1	18 50	43 48	19 12	44 36	19 33	45 23	19 55	46 10	20 16	46 58	20 38	55	55 1
50	41 25	18 8	42 12	18 31	43 0	18 51	43 47	19 12	44 34	19 34	45 22	19 55	46 9	20 17	46 57	20 39	56	56 1
52	41 24	18 9	42 11	18 33	42 58	18 52	43 46	19 13	44 33	19 35	45 21	19 56	46 8	20 18	46 56	20 40	57	57 1
54	41 23	18 10	42 10	18 34	42 57	18 53	43 45	19 14	44 32	19 36	45 20	19 57	46 7	20 19	46 54	20 41	58	58 1
56	41 22	18 10	42 9	18 35	42 56	18 54	43 44	19 15	44 31	19 37	45 18	19 58	46 6	20 20	46 53	20 42	59	59 1
58	41 21	18 11	42 8	18 36	42 55	18 54	43 43	19 16	44 30	19 38	45 17	19 59	46 5	20 21	46 52	20 43	60	60 1

(38° and 39°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	A
	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°		
38°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	41 19	18 12 42	7 18	34 42	54 18	55 43	41 19	17 44	29 19	39 45	16 20	0 46	3 20	22 46	51 20	43 20	1	0
2	41 18	18 13 42	6 18	35 42	53 18	56 43	40 19	18 44	28 19	39 45	15 20	1 46	2 20	23 46	49 20	44 21	2	1
4	41 17	18 14 42	5 18	35 42	52 18	57 43	39 19	19 44	26 19	40 45	14 20	2 46	1 20	24 46	48 20	45 21	3	1
6	41 16	18 15 42	3 18	36 42	51 18	58 43	38 19	20 44	25 19	41 45	12 20	3 46	0 20	25 46	47 20	46 21	4	2
8	41 15	18 16 42	2 18	37 42	50 18	59 43	37 19	21 44	24 19	42 45	11 20	4 45	58 20	26 46	46 20	47 21	5	3
10	41 14	18 17 42	1 18	38 42	48 19	0 43	36 19	22 44	23 19	43 45	10 20	5 45	57 20	27 46	44 20	48 21	6	3
12	41 13	18 17 42	0 18	39 42	47 19	1 43	34 19	23 44	22 19	44 45	9 20	6 45	56 20	27 46	43 20	49 21	7	4
14	41 12	18 18 41	59 18	40 42	46 19	1 43	33 19	23 44	20 19	44 45	8 20	7 45	55 20	28 46	42 20	50 21	8	4
16	41 11	18 19 41	58 18	41 42	45 19	2 43	32 19	24 44	19 19	46 45	6 20	8 45	54 20	29 46	41 20	51 21	9	4
18	41 10	18 20 41	57 18	41 42	44 19	3 43	31 19	24 44	18 19	47 45	5 20	8 45	52 20	30 46	39 20	52 21	10	5
20	41 9	18 20 41	56 18	42 42	43 19	4 43	30 19	26 44	17 19	48 45	4 20	9 45	51 20	31 46	38 20	53 21	11	5
22	41 8	18 21 41	55 18	43 42	42 19	5 43	29 19	27 44	16 19	48 45	3 20	10 45	50 20	32 46	37 20	54 21	12	6
24	41 6	18 22 41	53 18	44 42	41 19	6 43	28 19	28 44	15 19	49 45	2 20	11 45	49 20	33 46	36 20	55 21	13	6
26	41 5	18 23 41	52 18	45 42	40 19	7 43	26 19	29 44	13 19	50 45	0 20	12 45	47 20	34 46	34 20	56 21	14	7
28	41 4	18 24 41	51 18	46 42	38 19	8 43	25 19	29 44	12 19	51 44	59 20	13 45	46 20	35 46	33 20	57 20	15	7
30	41 3	18 25 41	50 18	47 42	37 19	8 43	24 19	30 44	11 19	52 44	58 20	14 45	45 20	36 46	32 20	58 21	16	8
32	41 2	18 26 41	49 18	47 42	36 19	9 43	23 19	31 44	10 19	53 44	57 20	15 45	44 20	37 46	31 20	59 21	17	8
34	41 1	18 26 41	48 18	48 42	35 19	10 43	22 19	32 44	9 19	54 44	56 20	16 45	43 20	38 46	30 21	0	18	9
36	41 0	18 27 41	47 18	49 42	34 19	11 43	21 19	33 44	8 19	55 44	54 20	17 45	41 20	39 46	28 21	1	19	9
38	40 59	18 28 41	46 18	50 42	33 19	12 43	20 19	34 44	6 19	56 44	53 20	18 45	40 20	40 46	27 21	1	20	10
40	40 58	18 29 41	45 18	51 42	31 19	13 43	18 19	35 44	5 19	57 44	52 20	18 45	39 20	40 46	26 21	2	21	10
42	40 57	18 30 41	44 18	52 42	30 19	14 43	17 19	36 44	4 19	58 44	51 20	19 45	38 20	41 46	25 21	3	22	11
44	40 56	18 31 41	42 18	53 42	29 19	15 43	16 19	36 44	3 19	58 44	50 20	20 45	36 20	42 46	23 21	4	23	11
46	40 55	18 31 41	41 18	53 42	28 19	15 43	15 19	37 44	2 19	59 44	48 20	21 45	35 20	43 46	22 21	5	24	11
48	40 53	18 32 41	40 18	54 42	27 19	16 43	14 19	38 44	0 20	0 44	47 20	22 45	34 20	44 46	21 21	6	25	12
50	40 52	18 33 41	39 18	55 42	26 19	17 43	13 19	39 44	59 20	1 44	46 20	23 45	33 20	45 46	20 21	7	26	12
52	40 51	18 34 41	38 18	56 42	25 19	18 43	11 19	40 44	58 20	2 44	45 20	24 45	32 20	46 46	18 21	8	27	13
54	40 50	18 35 41	37 18	57 42	24 19	19 43	10 19	41 44	57 20	3 44	44 20	25 45	30 20	47 46	17 21	9	28	13
56	40 49	18 36 41	36 18	58 42	22 19	20 43	9 19	42 44	56 20	4 44	42 20	26 45	29 20	48 46	16 21	10	29	14
58	40 48	18 37 41	35 18	59 42	21 19	21 43	8 19	43 44	55 20	5 44	41 20	27 45	28 20	49 46	15 21	11	30	14
39°	54'	55'	56'	57'	58'	59'	60'	61'										
0'	40 47	18 37 41	33 18	59 42	20 19	21 43	7 19	44 43	53 20	6 44	40 20	28 45	27 20	50 46	13 21	12	41	15
2	40 46	18 38 41	32 18	0 42	19 19	22 43	6 19	44 43	52 20	7 44	39 20	29 45	26 20	51 46	12 21	13	42	15
4	40 45	18 39 41	31 18	1 42	18 19	23 43	4 19	45 43	51 20	7 44	38 20	30 45	24 20	52 46	11 21	14	43	16
6	40 44	18 40 41	30 18	2 42	17 19	24 43	3 19	46 43	50 20	8 44	36 20	30 45	23 20	53 46	10 21	15	45	17
8	40 42	18 41 41	29 18	3 42	16 19	25 43	2 19	47 43	49 20	9 44	35 20	31 45	22 20	53 46	8 21	16	46	17
10	40 41	18 42 41	28 18	4 42	14 19	26 43	1 19	48 43	47 20	10 44	34 20	32 45	21 20	54 46	7 21	17	47	17
12	40 40	18 42 41	27 18	5 42	13 19	27 43	0 19	49 43	46 20	11 44	33 20	33 45	19 20	55 46	6 21	18	48	18
14	40 39	18 43 41	26 18	5 42	12 19	28 42	59 19	50 43	45 20	12 44	31 20	34 45	18 20	56 46	5 21	19	50	18
16	40 38	18 44 41	24 18	6 42	11 19	28 42	57 19	51 43	44 20	13 44	30 20	35 45	17 20	57 46	3 21	19	51	19
18	40 37	18 45 41	23 18	7 42	10 19	29 42	56 19	51 43	43 20	14 44	29 20	36 45	16 20	58 46	2 21	20	52	19
20	40 36	18 46 41	22 18	8 42	9 19	30 42	55 19	52 43	41 20	15 44	28 20	37 45	14 20	59 46	1 21	21	53	41
22	40 35	18 47 41	21 18	9 42	7 19	31 42	54 19	53 43	40 20	16 44	27 20	38 45	13 21	0 45	59 21	22	54	42
24	40 33	18 47 41	20 19	10 42	6 19	32 42	53 19	54 43	39 20	16 44	25 20	39 45	12 21	1 45	58 21	23	56	44
26	40 32	18 48 41	19 19	10 42	5 19	33 42	51 19	55 43	38 20	17 44	24 20	40 45	10 21	2 45	57 21	24	57	45
28	40 31	18 49 41	18 19	11 42	4 19	34 42	50 19	56 43	37 20	18 44	23 20	40 45	9 21	3 45	56 21	25	58	45
30	40 30	18 50 41	16 19	12 42	3 19	34 42	49 19	57 43	35 20	19 44	22 20	41 45	8 21	4 45	54 21	26	59	46
32	40 29	18 51 41	15 19	13 42	2 19	35 42	48 19	58 43	34 20	20 44	20 20	42 45	7 21	5 45	53 21	27		
34	40 28	18 52 41	14 19	14 42	0 19	36 42	47 19	58 43	33 20	21 44	19 20	43 45	6 21	5 45	52 21	28		
36	40 27	18 53 41	13 19	15 41	59 19	37 42	46 19	59 43	32 20	22 44	18 20	44 45	4 21	6 45	51 21	29		
38	40 26	18 53 41	12 19	16 41	58 19	38 42	44 20	0 43	31 20	23 44	17 20	45 45	3 21	7 45	49 21	30		
40	40 25	18 54 41	11 19	16 41	57 19	39 42	43 20	1 43	29 20	23 44	16 20	46 45	2 21	8 45	48 21	31		
42	40 23	18 55 41	10 19	17 41	56 19	40 42	42 20	2 43	28 20	24 44	14 20	47 45	0 21	9 45	47 21	32		
44	40 22	18 56 41	9 19	18 41	54 19	40 42	41 20	3 43	27 20	25 44	13 20	48 44	59 21	10 45	45 21	32		
46	40 21	18 56 41	7 19	19 41	53 19	41 42	40 20	4 43	26 20	26 44	12 20	49 44	58 21	11 45	44 21	33		
48	40 20	18 57 41	6 19	20 41	52 19	42 42	38 20	5 43	25 20	27 44	11 20	49 44	57 21	12 45	43 21	34		
50	40 19	18 58 41	5 19	21 41	51 19	43 42	37 20	5 43	23 20	28 44	9 20	50 44	56 21	13 45	42 21	35		
52	40 18	18 59 41	4 19	21 41	50 19	44 42	36 20	6 43	22 20	29 44	8 20	51 44	54 21	14 45	40 21	36		
54	40 17	19 0 41	3 19	22 41	49 19	45 42	35 20	7 43	21 20	30 44	7 20	52 44	53 21	15 45	39 21	37		
56	40 16	19 1 41	2 19															

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (40° and 41°)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									"	"
40°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	1	0
0'	40 13	19 2 40	59 19 25	41 45	19 47	42 31	20 10	43 17	20 32	44 3	20 55	44 49	21 17	45 35	21 40		1	0
2	40 12	19 3 40	58 19 26	41 44	19 48	42 30	20 11	43 16	20 33	44 2	20 56	44 48	21 18	45 34	21 41		2	1
4	40 11	19 4 40	57 19 26	41 43	19 49	42 29	20 12	43 15	20 34	44 1	20 57	44 47	21 19	45 33	21 42		3	1
6	40 10	19 5 40	56 19 27	41 42	19 50	42 28	20 13	43 14	20 35	43 59	20 58	44 45	21 20	45 31	21 43		4	2
8	40 9	19 6 40	55 19 28	41 41	19 51	42 27	20 13	43 12	20 36	43 58	20 58	44 44	21 21	45 30	21 44		5	3
10	40 8	19 6 40	54 19 29	41 39	19 52	42 25	20 14	43 11	20 37	43 57	20 59	44 43	21 22	45 29	21 45		6	3
12	40 6	19 7 40	52 19 30	41 38	19 52	42 24	20 15	43 10	20 38	43 56	21 0	44 42	21 23	45 27	21 46		7	4
14	40 5	19 8 40	51 19 31	41 37	19 53	42 23	20 16	43 9	20 39	43 54	21 1	44 40	21 24	45 26	21 46		8	4
16	40 4	19 9 40	50 19 32	41 36	19 54	42 22	20 17	43 7	20 39	43 53	21 2	44 39	21 25	45 25	21 47		9	5
18	40 3	19 10 40	49 19 32	41 35	19 55	42 20	20 18	43 6	20 40	43 52	21 3	44 38	21 26	45 24	21 48		10	5
20	40 2	19 10 40	48 19 33	41 33	19 56	42 19	20 18	43 5	20 41	43 51	21 4	44 36	21 26	45 22	21 49		11	6
22	40 1	19 11 40	47 19 34	41 32	19 57	42 18	20 19	43 4	20 42	43 49	21 5	44 35	21 27	45 21	21 50		12	6
24	40 0	19 12 40	45 19 35	41 31	19 57	42 17	20 20	43 3	20 43	43 48	21 6	44 34	21 28	45 20	21 51		13	6
26	39 58	19 13 40	44 19 36	41 30	19 58	42 16	20 21	43 2	20 44	43 47	21 7	44 33	21 29	45 18	21 52		14	7
28	39 57	19 14 40	43 19 36	41 29	19 59	42 14	20 22	43 1	20 45	43 46	21 8	44 31	21 30	45 17	21 53		15	8
30	39 56	19 15 40	42 19 37	41 27	20 0	42 13	20 23	42 59	20 46	43 44	21 9	44 30	21 31	45 16	21 54		16	8
32	39 55	19 15 40	41 19 38	41 26	20 1	42 12	20 24	42 58	20 46	43 43	21 10	44 29	21 32	45 14	21 55		17	9
34	39 54	19 16 40	40 19 39	41 25	20 2	42 11	20 25	42 56	20 47	43 42	21 11	44 28	21 33	45 13	21 56		18	9
36	39 53	19 17 40	38 19 40	41 24	20 3	42 10	20 25	42 55	20 48	43 41	21 12	44 26	21 34	45 12	21 57		19	10
38	39 52	19 18 40	37 19 41	41 23	20 4	42 9	20 26	42 54	20 49	43 39	21 13	44 25	21 35	45 10	21 57		20	10
40	39 50	19 19 40	36 19 41	41 22	20 4	42 7	20 27	42 53	20 50	43 38	21 14	44 24	21 36	45 9	21 58		21	11
42	39 49	19 19 40	35 19 42	41 20	20 5	42 6	20 28	42 51	20 51	43 37	21 15	44 22	21 37	45 8	21 59		22	11
44	39 48	19 20 40	34 19 43	41 19	20 6	42 5	20 29	42 50	20 52	43 36	21 16	44 21	21 37	45 7	22 0		23	11
46	39 47	19 21 40	33 19 44	41 18	20 7	42 3	20 30	42 49	20 53	43 34	21 17	44 20	21 38	45 5	22 1		24	12
48	39 46	19 22 40	31 19 45	41 17	20 8	42 2	20 31	42 48	20 53	43 33	21 18	44 19	21 39	45 4	22 2		25	13
50	39 45	19 23 40	30 19 46	41 16	20 9	42 1	20 31	42 46	20 54	43 32	21 19	44 17	21 40	45 3	22 3		26	13
52	39 44	19 24 40	29 19 46	41 14	20 9	42 0	20 32	42 45	20 55	43 31	21 20	44 16	21 41	45 1	22 4		27	13
54	39 43	19 24 40	28 19 47	41 13	20 10	41 59	20 33	42 44	20 56	43 29	21 21	44 15	21 42	45 0	22 5		28	14
56	39 41	19 25 40	27 19 48	41 12	20 11	41 57	20 34	42 43	20 57	43 28	21 22	44 14	21 43	45 59	22 6		29	15
58	39 40	19 26 40	26 19 49	41 11	20 12	41 56	20 35	42 41	20 58	43 27	21 23	44 12	21 44	45 57	22 7		30	15
41°	54'	55'	56'	57'	58'	59'	60'	61'									40	15
0'	39 39	19 27	40 24	19 50	41 10	20 13	41 55	20 36	42 40	20 59	43 25	21 22	44 11	21 45	44 56	22 8		16
2	39 38	19 28	40 23	19 51	41 8	20 14	41 54	20 37	42 39	21 0	43 24	21 23	44 9	21 46	44 55	22 9		16
4	39 37	19 28	40 22	19 51	41 7	20 14	41 52	20 37	42 38	21 1	43 23	21 23	44 8	21 46	44 53	22 10		17
6	39 36	19 29	40 21	19 52	41 6	20 15	41 51	20 38	42 36	21 1	43 22	21 24	44 7	21 47	44 52	22 10		17
8	39 34	19 30	40 20	19 53	41 5	20 16	41 50	20 39	42 35	21 2	43 20	21 25	44 6	21 48	44 51	22 11		18
10	39 33	19 31	40 18	19 54	41 4	20 17	41 49	20 40	42 34	21 3	43 19	21 26	44 5	21 49	44 49	22 12		18
12	39 32	19 32	40 17	19 55	41 2	20 18	41 47	20 41	42 33	21 4	43 18	21 27	44 3	21 50	44 48	22 13		19
14	39 31	19 33	40 16	19 56	41 1	20 19	41 46	20 42	42 31	21 5	43 16	21 28	44 2	21 51	44 47	22 14		19
16	39 30	19 34	40 15	19 56	41 0	20 20	41 45	20 43	42 30	21 6	43 15	21 29	44 1	21 52	44 45	22 15		20
18	39 28	19 34	40 14	19 57	40 59	20 20	41 44	20 43	42 29	21 7	43 14	21 30	43 59	21 53	44 44	22 16		20
20	39 27	19 35	40 12	19 58	40 57	20 21	41 42	20 44	42 27	21 8	43 13	21 30	43 58	21 54	44 43	22 17		21
22	39 26	19 36	40 11	19 59	40 56	20 22	41 41	20 45	42 26	21 9	43 11	21 31	43 56	21 55	44 41	22 18		21
24	39 25	19 37	40 10	20 0	40 55	20 23	41 40	20 46	42 25	21 10	43 10	21 32	43 55	21 55	44 40	22 19		22
26	39 24	19 37	40 9	20 0	40 54	20 24	41 39	20 47	42 24	21 11	43 9	21 33	43 54	21 56	44 39	22 20		22
28	39 23	19 38	40 8	20 1	40 52	20 25	41 38	20 48	42 22	21 12	43 7	21 34	43 52	21 57	44 37	22 20		23
30	39 21	19 39	40 6	20 2	40 51	20 25	41 36	20 49	42 21	21 13	43 6	21 35	43 51	21 58	44 36	22 21		23
32	39 20	19 40	40 5	20 3	40 50	20 26	41 35	20 49	42 20	21 14	43 5	21 36	43 50	21 59	44 35	22 22		24
34	39 19	19 41	40 4	20 4	40 49	20 27	41 34	20 50	42 19	21 15	43 4	21 37	43 48	22 0	44 33	22 23		24
36	39 18	19 41	40 3	20 5	40 48	20 28	41 33	20 51	42 17	21 16	43 3	21 38	43 47	22 1	44 32	22 24		25
38	39 17	19 42	40 2	20 6	40 47	20 29	41 31	20 52	42 16	21 17	43 2	21 38	43 46	22 2	44 31	22 25		25
40	39 16	19 43	40 0	20 6	40 45	20 29	41 30	20 53	42 15	21 18	43 1	21 39	43 45	22 3	44 29	22 26		26
42	39 14	19 44	39 59	20 7	40 44	20 30	41 29	20 54	42 14	21 19	42 58	21 40	43 43	22 4	44 28	22 27		27
44	39 13	19 45	39 58	20 8	40 43	20 31	41 28	20 54	42 12	21 20	42 57	21 41	43 42	22 5	44 27	22 28		28
46	39 12	19 45	39 57	20 9	40 42	20 32	41 26	20 55	42 11	21 21	42 56	21 42	43 41	22 6	44 25	22 29		29
48	39 11	19 46	39 56	20 9	40 40	20 33	41 25	20 56	42 10	21 22	42 55	21 43	43 39	22 7	44 24	22 30		30
50	39 10	19 47	39 54	20 10	40 39	20 34	41 24	20 57	42 9	21 23	42 53	21 44	43 38	22 8	44 23	22 31		31
52	39 9	19 48	39 53	20 11	40 38	20 34	41 23	20 58	42 8	21 24	42 52	21 45	43 37	22 9	44 21	22 32		32
54	39 7	19 49	39 52	20 12	40 37	20 35	41 21	20 59	42 6	21 25	42 51	21 46	43 35	22 10	44 20	22 33		33
56	39 6	19 50	39 51	20 13	40 36	20 36	41 20	21 0	42 5	21 26	42 49	21 47	43 34	22 11	44 19	22 34		34
58	39 5	19 50	39 50	20 13	40 34	20 37	41 19	21 0	42 4	21 27	42 48	21 47	43 33	22 12	44 17	22 34		35

(42° and 43°) The Correction of the Moon's Altitude, and the Aux. Angle A (w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																		Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	A.		
42°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	A.		
0'	39 4	19 51	39 48	20 14	40 33	20 38	41 18	21 14	2 21	25 42	47 21	48 43	31 22	11 44	16 22	35 2	1 1	0		
2	39 3	19 52	39 47	20 15	40 32	20 39	41 16	21 2	2 22	25 42	46 21	49 43	30 22	12 44	15 22	36 4	3 2	1		
4	39 1	19 52	39 46	20 16	40 31	20 39	41 15	21 3	2 22	25 42	44 21	50 43	29 22	13 44	13 22	37 5	4 2	2		
6	39 0	19 53	39 45	20 17	40 29	20 40	41 14	21 4	2 21	25 42	43 21	51 43	27 22	14 44	12 22	38 6	5 2	3		
8	38 59	19 54	39 44	20 18	40 28	20 41	41 13	21 5	2 21	25 42	42 21	51 43	26 22	15 44	11 22	38 7	6 3	4		
10	38 58	19 55	39 42	20 18	40 27	20 42	41 11	21 5	2 21	25 42	40 21	52 43	25 22	16 44	9 22	39 8	7 4	5		
12	38 57	19 56	39 41	20 19	40 26	20 43	41 10	21 6	2 21	25 42	39 21	53 43	23 22	17 44	8 22	40 9	8 5	6		
14	38 55	19 56	39 40	20 20	40 24	20 43	41 9	21 7	2 21	25 42	38 21	54 43	22 22	18 44	7 22	41 10	9 6	7		
16	38 54	19 57	39 39	20 21	40 23	20 44	41 8	21 8	2 21	25 42	36 21	55 43	21 22	18 44	5 22	42 11	10 7	8		
18	38 53	19 58	39 38	20 22	40 22	20 45	41 6	21 9	2 21	25 42	35 21	56 43	19 22	19 44	4 22	43 12	11 8	9		
20	38 52	19 59	39 36	20 22	40 21	20 46	41 5	21 10	2 21	25 42	34 21	57 43	18 22	20 44	3 22	44 13	12 9	10		
22	38 51	20 0	39 35	20 23	40 19	20 47	41 4	21 10	2 21	25 42	32 21	57 43	17 22	21 44	2 22	45 14	13 10	11		
24	38 49	20 0	39 34	20 24	40 18	20 48	41 2	21 11	2 21	25 42	31 21	58 43	15 22	22 44	0 22	46 15	14 11	12		
26	38 48	20 1	39 33	20 25	40 17	20 48	41 1	21 12	2 21	25 42	30 21	59 43	14 22	23 44	58 22	46 16	15 12	13		
28	38 47	20 2	39 31	20 26	40 16	20 49	41 0	21 13	2 21	25 42	28 21	59 43	13 22	24 44	57 22	47 17	16 13	14		
30	38 46	20 3	39 30	20 26	40 14	20 50	40 59	21 14	2 21	25 42	27 21	59 43	11 22	25 44	56 22	48 18	17 14	15		
32	38 45	20 4	39 29	20 27	40 13	20 51	40 57	21 15	2 21	25 42	26 21	59 43	10 22	26 44	55 22	49 19	18 15	16		
34	38 43	20 4	39 28	20 28	40 12	20 52	40 56	21 15	2 21	25 42	24 21	59 43	9 22	26 44	53 22	50 20	19 16	17		
36	38 42	20 5	39 26	20 29	40 11	20 53	40 55	21 16	2 21	25 42	23 21	59 43	8 22	27 44	52 22	51 21	20 17	18		
38	38 41	20 6	39 25	20 30	40 10	20 54	40 54	21 17	2 21	25 42	22 21	59 43	7 22	27 44	50 22	52 22	21 18	19		
40	38 40	20 7	39 24	20 30	40 8	20 54	40 52	21 18	2 21	25 42	20 21	59 43	6 22	28 44	49 22	53 23	22 19	20		
42	38 39	20 8	39 23	20 31	40 7	20 55	40 51	21 19	2 21	25 42	19 21	59 43	5 22	28 44	47 22	54 24	23 20	21		
44	38 37	20 8	39 22	20 32	40 6	20 56	40 50	21 20	2 21	25 42	18 21	59 43	4 22	29 44	46 22	55 25	24 21	22		
46	38 36	20 9	39 20	20 33	40 5	20 57	40 49	21 20	2 21	25 42	17 21	59 43	3 22	29 44	45 22	56 26	25 22	23		
48	38 35	20 10	39 19	20 34	40 4	20 57	40 47	21 21	2 21	25 42	15 21	59 43	2 22	30 44	43 22	56 27	26 23	24		
50	38 34	20 11	39 18	20 35	40 2	20 58	40 46	21 22	2 21	25 42	14 21	59 43	1 22	30 44	42 22	57 28	27 24	25		
52	38 33	20 12	39 17	20 35	40 1	20 59	40 45	21 23	2 21	25 42	13 21	59 43	1 22	31 44	41 22	58 29	28 25	26		
54	38 31	20 12	39 16	20 36	40 0	20 59	40 44	21 24	2 21	25 42	12 21	59 43	1 22	32 44	40 22	59 30	29 26	27		
56	38 30	20 13	39 14	20 37	39 58	21 1	40 42	21 25	2 21	25 42	10 21	59 43	1 22	33 44	39 22	60 31	30 27	28		
58	38 29	20 14	39 13	20 38	39 57	21 2	40 41	21 25	2 21	25 42	9 21	59 43	1 22	34 44	38 22	61 32	31 28	29		
43°	54'	55'	56'	57'	58'	59'	60'	61'												
0'	38 28	20 15	39 12	20 39	39 56	21 2	40 40	21 26	41 24	21 50	42 8	22 14	42 52	22 38	43 35	23 2	41 30	26		
2	38 27	20 15	39 11	20 39	39 55	21 3	40 38	21 27	41 22	21 51	42 6	22 15	42 50	22 39	43 34	23 3	42 31	17		
4	38 25	20 16	39 9	20 40	39 53	21 4	40 37	21 28	41 21	21 52	42 5	22 16	42 49	22 40	43 32	23 4	43 31	17		
6	38 24	20 17	39 8	20 41	39 52	21 5	40 36	21 29	41 20	21 53	42 4	22 17	42 47	22 41	43 31	23 5	44 32	18		
8	38 23	20 18	39 7	20 42	39 51	21 6	40 35	21 30	41 18	21 54	42 2	22 18	42 46	22 42	43 30	23 7	45 34	19		
10	38 22	20 19	39 6	20 43	39 49	21 7	40 33	21 31	41 17	21 55	42 1	22 19	42 45	22 44	43 28	23 8	46 35	20		
12	38 21	20 19	39 4	20 44	39 48	21 8	40 32	21 32	41 16	21 56	41 59	22 21	42 43	22 45	43 27	23 9	47 36	21		
14	38 19	20 20	39 3	20 44	39 47	21 9	40 31	21 33	41 14	21 57	41 58	22 22	42 42	22 46	43 25	23 10	48 37	22		
16	38 18	20 21	39 2	20 45	39 45	21 10	40 29	21 34	41 13	21 58	41 57	22 23	42 40	22 47	43 24	23 11	49 38	23		
18	38 17	20 22	39 1	20 46	39 44	21 11	40 28	21 35	41 12	21 59	41 55	22 24	42 39	22 48	43 23	23 12	50 39	24		
20	38 16	20 22	38 59	20 47	39 43	21 11	40 27	21 36	41 10	22 0	41 54	22 25	42 37	22 49	43 21	23 14	51 40	25		
22	38 14	20 23	38 58	20 48	39 42	21 12	40 25	21 37	41 9	22 1	41 53	22 26	42 36	22 50	43 20	23 15	52 41	26		
24	38 13	20 24	38 57	20 49	39 40	21 13	40 24	21 38	41 8	22 2	41 51	22 27	42 35	22 52	43 18	23 16	53 42	27		
26	38 12	20 25	38 56	20 50	39 39	21 14	40 23	21 39	41 6	22 3	41 50	22 28	42 33	22 53	43 17	23 17	54 43	28		
28	38 11	20 26	38 54	20 50	39 38	21 15	40 21	21 40	41 5	22 4	41 48	22 29	42 32	22 54	43 16	23 19	55 44	29		
30	38 9	20 26	38 53	20 51	39 37	21 16	40 20	21 41	41 4	22 5	41 47	22 30	42 31	22 55	43 14	23 20	56 45	30		
32	38 8	20 27	38 52	20 52	39 35	21 17	40 19	21 42	41 3	22 6	41 46	22 31	42 29	22 56	43 13	23 21	57 46	31		
34	38 7	20 28	38 51	20 53	39 34	21 18	40 17	21 43	41 2	22 7	41 44	22 32	42 28	22 57	43 11	23 22	58 47	32		
36	38 6	20 29	38 49	20 54	39 33	21 19	40 16	21 44	41 0	22 8	41 43	22 34	42 27	22 58	43 10	23 23	59 48	33		
38	38 5	20 30	38 48	20 55	39 31	21 20	40 15	21 45	40 58	22 9	41 42	22 35	42 25	23 0	43 9	23 24	60 49	34		
40	38 3	20 30	38 47	20 55	39 30	21 20	40 14	21 46	40 57	22 11	41 40	22 36	42 24	23 1	43 7	23 26	61 50	35		
42	38 2	20 31	38 46	20 56	39 29	21 21	40 12	21 47	40 56	22 12	41 39	22 37	42 22	23 2	43 6	23 27	62 51	36		
44	38 1	20 32	38 44	20 57	39 28	21 22	40 11	21 48	40 54	22 13	41 38	22 38	42 21	23 3	43 5	23 28	63 52	37		
46	38 0	20 33	38 43	20 58	39 26	21 23	40 10	21 49	40 53	22 14	41 36	22 39	42 20	23 4	43 3	23 30	64 53	38		
48	37 58	20 33	38 42	20 59	39 25	21 24	40 8	21 49	40 52	22 15	41 35	22 40	42 18	23 5	43 2	23 31	65 54	39		
50	37 57	20 34	38 41	21 0	39 24	21 25	40 7	21 50	40 50	22 16	41 34	22 41	42 17	23 6	43 1	23 32	66 55	40		
52	37 56	20 35	38 39	21 0	39 23	21 26	40 6	21 51	40 49	22 17	41 32	22 42	42 16	23 7	42 59	23 33	67 56	41		
54	37 55	20 36	38 38	21 1	39 21	21 27	40 4	21 52	40 48	22 18	41 31	22 43	42 14	23 8	42 57	23 34	68 57	42		
56	37 54	20 36	38 37	21 2	39 20	21 28														

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (44° and 45°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
44°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	37 51	20 38	38 34	21 4	39 17	21 29	40 1	21 55	40 44	22 21	41 27	22 47	42 10	23 13	42 53	23 38	1	0
2	37 50	20 39	38 33	21 5	39 16	21 30	39 59	21 56	40 42	22 22	41 26	22 47	42 9	23 13	42 52	23 39	2	1
4	37 49	20 40	38 32	21 6	39 15	21 31	39 58	21 57	40 41	22 22	41 24	22 48	42 7	23 14	42 50	23 39	3	2
6	37 47	20 40	38 30	21 6	39 14	21 32	39 57	21 57	40 40	22 23	41 23	22 48	42 6	23 14	42 49	23 40	4	3
8	37 46	20 41	38 29	21 7	39 12	21 32	39 55	21 58	40 38	22 23	41 21	22 49	42 5	23 15	42 48	23 40	5	4
10	37 45	20 42	38 28	21 7	39 11	21 33	39 54	21 59	40 37	22 24	41 20	22 50	42 3	23 15	42 46	23 41	6	5
12	37 44	20 43	38 27	21 8	39 10	21 34	39 53	21 59	40 36	22 25	41 19	22 50	42 2	23 16	42 45	23 41	7	6
14	37 42	20 43	38 25	21 9	39 9	21 34	39 51	22 0	40 34	22 25	41 17	22 51	42 0	23 16	42 43	23 42	8	7
16	37 41	20 44	38 24	21 10	39 7	21 35	39 50	22 1	40 33	22 26	41 16	22 51	41 59	23 17	42 42	23 42	9	8
18	37 40	20 45	38 23	21 11	39 6	21 36	39 49	22 1	40 32	22 27	41 15	22 52	41 58	23 17	42 41	23 43	10	9
20	37 39	20 46	38 21	21 11	39 4	21 36	39 47	22 2	40 30	22 27	41 13	22 53	41 56	23 18	42 39	23 43	11	10
22	37 37	20 47	38 20	21 12	39 3	21 37	39 46	22 2	40 29	22 28	41 12	22 53	41 55	23 18	42 38	23 44	12	11
24	37 36	20 47	38 19	21 13	39 2	21 38	39 45	22 3	40 28	22 28	41 10	22 54	41 53	23 19	42 36	23 44	13	12
26	37 35	20 48	38 18	21 13	39 1	21 39	39 43	22 4	40 26	22 29	41 9	22 54	41 52	23 20	42 35	23 45	14	13
28	37 34	20 49	38 16	21 14	38 59	21 39	39 42	22 5	40 25	22 30	41 8	22 55	41 51	23 20	42 33	23 45	15	14
30	37 32	20 50	38 15	21 15	38 58	21 40	39 41	22 5	40 24	22 30	41 6	22 56	41 49	23 21	42 32	23 46	16	15
32	37 31	20 50	38 14	21 16	38 57	21 41	39 39	22 6	40 22	22 31	41 5	22 56	41 48	23 21	42 31	23 46	17	16
34	37 30	20 51	38 13	21 16	38 55	21 41	39 38	22 7	40 21	22 32	41 4	22 57	41 46	23 22	42 29	23 47	18	17
36	37 29	20 52	38 11	21 17	38 54	21 42	39 37	22 7	40 19	22 32	41 2	22 57	41 45	23 22	42 28	23 48	19	18
38	37 27	20 53	38 10	21 18	38 53	21 43	39 36	22 8	40 18	22 33	41 1	22 58	41 44	23 23	42 26	23 48	20	19
40	37 26	20 54	38 9	21 18	38 51	21 43	39 34	22 8	40 17	22 33	40 59	22 58	41 42	23 24	42 25	23 49	21	20
42	37 25	20 54	38 8	21 19	38 50	21 44	39 33	22 9	40 15	22 34	40 58	22 59	41 41	23 24	42 23	23 49	22	21
44	37 24	20 55	38 6	21 20	38 49	21 45	39 32	22 10	40 14	22 35	40 57	23 0	41 39	23 25	42 22	23 50	23	22
46	37 22	20 56	38 5	21 21	38 48	21 46	39 30	22 11	40 13	22 35	40 55	23 0	41 38	23 25	42 21	23 50	24	23
48	37 21	20 56	38 4	21 21	38 46	21 46	39 29	22 11	40 11	22 36	40 54	23 0	41 37	23 26	42 19	23 51	25	24
50	37 20	20 57	38 3	21 22	38 45	21 47	39 28	22 12	40 10	22 37	40 53	23 0	41 35	23 26	42 18	23 51	26	25
52	37 19	20 58	38 2	21 23	38 44	21 48	39 26	22 13	40 9	22 37	40 51	23 0	41 34	23 27	42 16	23 52	27	26
54	37 17	20 59	38 1	21 24	38 42	21 48	39 25	22 13	40 7	22 38	40 50	23 0	41 32	23 28	42 15	23 52	28	27
56	37 16	21 0	37 59	21 25	38 41	21 49	39 24	22 14	40 6	22 39	40 49	23 0	41 31	23 28	42 14	23 53	29	28
58	37 15	21 0	37 57	21 25	38 40	21 50	39 22	22 15	40 5	22 39	40 47	23 0	41 30	23 29	42 12	23 53	30	29
45°	54'		55'		56'		57'		58'		59'		60'		61'			
0'	37 14	21 1	37 56	21 26	38 38	21 50	39 21	22 15	40 3	22 40	40 46	23 5	41 28	23 29	42 11	23 54	31	30
2	37 12	21 1	37 55	21 27	38 37	21 51	39 20	22 16	40 2	22 41	40 44	23 5	41 27	23 30	42 9	23 55	32	31
4	37 11	21 1	37 53	21 27	38 36	21 52	39 18	22 17	40 1	22 42	40 43	23 6	41 25	23 31	42 8	23 56	33	32
6	37 10	21 1	37 52	21 28	38 35	21 53	39 17	22 18	39 59	22 42	40 42	23 7	41 24	23 32	42 6	23 57	34	33
8	37 8	21 1	37 51	21 29	38 33	21 54	39 15	22 18	39 58	22 43	40 40	23 8	41 23	23 33	42 5	23 57	35	34
10	37 7	21 1	37 49	21 30	38 32	21 54	39 14	22 19	39 56	22 44	40 39	23 9	41 21	23 33	42 3	23 58	36	35
12	37 6	21 1	37 48	21 30	38 31	21 55	39 13	22 20	39 55	22 45	40 37	23 10	41 20	23 34	42 2	23 59	37	36
14	37 5	21 1	37 47	21 31	38 29	21 56	39 11	22 21	39 54	22 46	40 36	23 10	41 18	23 35	42 0	24 0	38	37
16	37 3	21 1	37 46	21 32	38 28	21 57	39 10	22 22	39 52	22 46	40 35	23 11	41 17	23 36	41 59	24 1	39	38
18	37 2	21 1	37 44	21 33	38 27	21 58	39 9	22 22	39 51	22 47	40 33	23 12	41 15	23 37	41 58	24 2	40	39
20	37 1	21 1	37 43	21 33	38 25	21 58	39 7	22 23	39 49	22 48	40 32	23 13	41 14	23 38	41 56	24 3	41	40
22	37 0	21 1	37 42	21 34	38 24	21 59	39 6	22 24	39 48	22 49	40 30	23 14	41 12	23 39	41 55	24 4	42	41
24	36 58	21 1	37 40	21 35	38 23	22 0	39 5	22 25	39 47	22 50	40 29	23 15	41 11	23 39	41 53	24 5	43	42
26	36 57	21 1	37 39	21 36	38 21	22 1	39 3	22 26	39 45	22 50	40 27	23 15	41 10	23 40	41 52	24 6	44	43
28	36 56	21 1	37 38	21 37	38 20	22 1	39 2	22 26	39 44	22 51	40 26	23 16	41 8	23 41	41 50	24 7	45	44
30	36 54	21 1	37 36	21 37	38 19	22 2	39 1	22 27	39 43	22 52	40 25	23 17	41 7	23 42	41 49	24 8	46	45
32	36 53	21 1	37 35	21 38	38 17	22 3	38 59	22 28	39 41	22 53	40 23	23 18	41 5	23 43	41 47	24 9	47	46
34	36 52	21 1	37 34	21 39	38 16	22 4	38 58	22 29	39 40	22 54	40 22	23 19	41 4	23 44	41 46	24 10	48	47
36	36 51	21 1	37 33	21 40	38 15	22 5	38 57	22 30	39 39	22 54	40 20	23 19	41 2	23 44	41 44	24 11	49	48
38	36 49	21 1	37 31	21 40	38 13	22 6	38 55	22 30	39 37	22 55	40 19	23 20	41 1	23 45	41 43	24 12	50	49
40	36 48	21 1	37 30	21 41	38 12	22 7	38 54	22 31	39 36	22 56	40 18	23 21	41 0	23 46	41 42	24 13	51	50
42	36 47	21 1	37 29	21 42	38 11	22 8	7 58	22 32	39 34	22 57	40 16	23 22	40 58	23 47	41 40	24 14	52	51
44	36 45	21 1	37 27	21 43	38 9	22 9	7 56	22 33	39 33	22 58	40 15	23 23	40 57	23 48	41 39	24 15	53	52
46	36 44	21 1	37 26	21 43	38 8	22 10	7 55	22 33	39 32	22 59	40 13	23 24	40 55	23 49	41 37	24 16	54	53
48	36 43	21 1	37 25	21 44	38 7	22 11	9 38	22 34	39 30	22 59	40 12	23 24	40 54	23 49	41 36	24 17	55	54
50	36 42	21 1	37 23	21 45	38 5	22 12	10 38	22 35	39 29	23 0	40 11	23 25	40 52	23 50	41 34	24 18	56	55
52	36 40	21 1	37 22	21 45	38 4	22 13	11 38	22 36	39 28	23 1	40 9	23 26	40 51	23 51	41 33	24 19	57	56
54	36 39	21 1	37 21	21 46	38 3	22 14	12 38	22 37	39 26	23 2	40 8	23 27	40 50	23 52	41 31	24 20	58	57
56	36 38	21 1	37 20	21 47	38 2	22 15	13 38	22 37	39 25	23 3	40 6	23 28	40 48	23 53	41 30	24 21	59	58
58	36 36	21 1	37 18	21 48	38 0	22 16	14 38	22 38	39 23	23 4	40 5	23 29	40 47	23 54	41 29	24 22	60	59

(46° and 47°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									"	"
46°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	36 35	21 24	37 17	21 49	37 59	22 14	38 40	22 39	39 22	23 40	4 23	29	40 45	23 55	41 27	24 20	1	0
2	36 34	21 24	37 16	21 50	37 57	22 15	38 39	22 40	39 21	23 54	4 23	30	40 44	23 55	41 26	24 21	2	1
4	36 33	21 25	37 14	21 50	37 56	22 16	38 38	22 41	39 19	23 64	4 23	31	40 42	23 56	41 24	24 21	3	2
6	36 31	21 26	37 13	21 51	37 55	22 16	38 36	22 41	39 18	23 73	39 59	23 32	40 41	23 57	41 23	24 22	4	3
8	36 30	21 27	37 12	21 52	37 53	22 17	38 35	22 42	39 16	23 79	39 58	23 33	40 40	23 58	41 21	24 23	5	3
10	36 28	21 27	37 10	21 53	37 52	22 18	38 33	22 43	39 15	23 83	39 57	23 33	40 38	23 59	41 20	24 24	6	4
12	36 27	21 28	37 9	21 53	37 51	22 19	38 32	22 44	39 14	23 93	39 55	23 34	40 37	24 0	41 18	24 25	7	4
14	36 26	21 29	37 8	21 54	37 49	22 19	38 31	22 45	39 12	23 10	39 54	23 35	40 35	24 0	41 17	24 26	8	5
16	36 25	21 30	37 6	21 55	37 48	22 20	38 29	22 45	39 11	23 11	39 52	23 36	40 34	24 1	41 15	24 26	9	6
18	36 23	21 30	37 5	21 56	37 46	22 21	38 28	22 46	39 9	23 11	39 51	23 37	40 32	24 1	41 14	24 27	10	6
20	36 22	21 31	37 4	21 56	37 45	22 22	38 26	22 47	39 8	23 12	39 49	23 37	40 31	24 1	41 12	24 28	11	6
22	36 21	21 32	37 2	21 57	37 44	22 22	38 25	22 48	39 7	23 13	39 48	23 38	40 29	24 1	41 11	24 29	12	7
24	36 20	21 33	37 1	21 58	37 42	22 23	38 24	22 48	39 5	23 14	39 47	23 39	40 28	24 1	41 9	24 30	13	8
26	36 18	21 33	37 0	21 58	37 41	22 24	38 23	22 49	39 4	23 15	39 45	23 40	40 26	24 1	41 8	24 30	14	8
28	36 17	21 34	36 58	21 59	37 40	22 25	38 21	22 50	39 2	23 15	39 44	23 41	40 25	24 1	41 6	24 31	15	9
30	36 16	21 35	36 57	22 0	37 38	22 25	38 20	22 51	39 0	23 16	39 42	23 41	40 23	24 1	41 5	24 32	16	9
32	36 14	21 36	36 56	22 0	37 37	22 26	38 18	22 52	38 59	23 17	39 41	23 42	40 22	24 1	41 3	24 33	17	10
34	36 13	21 36	36 54	22 1	37 36	22 27	38 17	22 52	38 58	23 18	39 39	23 43	40 21	24 1	41 2	24 34	18	10
36	36 12	21 37	36 53	22 1	37 34	22 28	38 15	22 53	38 57	23 18	39 38	23 44	40 19	24 1	41 0	24 35	19	11
38	36 10	21 38	36 52	22 1	37 33	22 29	38 14	22 54	38 55	23 19	39 36	23 45	40 18	24 1	40 59	24 35	20	11
40	36 9	21 38	36 50	22 1	37 31	22 29	38 13	22 55	38 54	23 20	39 35	23 45	40 16	24 1	40 57	24 36	21	11
42	36 8	21 39	36 49	22 1	37 30	22 30	38 11	22 55	38 52	23 21	39 34	23 46	40 15	24 1	40 56	24 37	22	12
44	36 6	21 40	36 48	22 1	37 29	22 31	38 10	22 56	38 51	23 22	39 32	23 47	40 13	24 1	40 54	24 38	23	12
46	36 5	21 41	36 46	22 1	37 27	22 32	38 9	22 57	38 50	23 22	39 31	23 48	40 12	24 1	40 53	24 39	24	13
48	36 4	21 41	36 45	22 1	37 26	22 32	38 7	22 58	38 48	23 23	39 29	23 49	40 10	24 1	40 51	24 40	25	14
50	36 3	21 42	36 44	22 1	37 25	22 33	38 6	22 59	38 47	23 24	39 28	23 49	40 9	24 1	40 50	24 40	26	14
52	36 1	21 43	36 42	22 1	37 23	22 34	38 4	22 59	38 45	23 25	39 26	23 50	40 7	24 1	40 49	24 41	27	15
54	36 0	21 44	36 41	22 1	37 22	22 35	38 3	23 0	38 44	23 26	39 25	23 51	40 6	24 1	40 47	24 42	28	15
56	35 59	21 44	36 40	22 1	37 21	22 35	38 2	23 1	38 43	23 26	39 24	23 52	40 5	24 1	40 46	24 43	29	16
58	35 57	21 45	36 38	22 1	37 19	22 36	38 0	23 2	38 41	23 27	39 22	23 53	40 3	24 1	40 44	24 44	30	17
47°	54'	55'	56'	57'	58'	59'	60'	61'									"	"
0'	35 56	21 46	36 37	22 11	37 18	22 37	37 59	23 23	38 40	23 28	39 21	23 53	40 2	24 1	40 43	24 44	31	17
2	35 55	21 47	36 36	22 12	37 17	22 38	37 57	23 3	38 38	23 29	39 19	23 54	40 1	24 1	40 41	24 45	32	18
4	35 53	21 47	36 34	22 13	37 15	22 38	37 56	23 4	38 37	23 29	39 18	23 55	39 59	24 1	40 40	24 46	33	18
6	35 52	21 48	36 33	22 14	37 14	22 39	37 55	23 5	38 36	23 30	39 16	23 56	39 57	24 1	40 38	24 47	34	19
8	35 51	21 49	36 32	22 15	37 12	22 40	37 53	23 6	38 34	23 31	39 15	23 57	39 56	24 1	40 37	24 48	35	20
10	35 49	21 49	36 30	22 15	37 11	22 41	37 52	23 6	38 33	23 32	39 13	23 58	39 54	24 1	40 35	24 49	36	20
12	35 48	21 50	36 29	22 16	37 10	22 41	37 50	23 7	38 31	23 33	39 12	23 58	39 53	24 1	40 34	24 50	37	21
14	35 47	21 51	36 28	22 17	37 8	22 42	37 49	23 8	38 30	23 33	39 11	23 59	39 51	24 1	40 32	24 50	38	21
16	35 45	21 52	36 26	22 17	37 7	22 43	37 48	23 9	38 28	23 34	39 9	24 0	39 50	24 1	40 31	24 51	39	22
18	35 44	21 52	36 25	22 18	37 5	22 44	37 46	23 9	38 27	23 35	39 8	24 1	39 48	24 1	40 29	24 52	40	22
20	35 43	21 53	36 23	22 19	37 4	22 44	37 45	23 10	38 25	23 36	39 6	24 1	39 47	24 1	40 27	24 53	41	23
22	35 41	21 54	36 22	22 20	37 2	22 45	37 43	23 11	38 24	23 37	39 5	24 1	39 45	24 1	40 26	24 54	42	23
24	35 40	21 55	36 21	22 20	37 1	22 46	37 42	23 12	38 23	23 37	39 3	24 1	39 44	24 1	40 24	24 55	43	24
26	35 39	21 55	36 19	22 21	37 0	22 47	37 41	23 12	38 21	23 38	39 2	24 1	39 42	24 1	40 23	24 55	44	24
28	35 37	21 56	36 18	22 22	36 59	22 47	37 39	23 13	38 20	23 39	39 0	24 1	39 41	24 1	40 21	24 56	45	25
30	35 36	21 57	36 17	22 22	36 57	22 48	37 38	23 14	38 18	23 40	38 59	24 1	39 39	24 1	40 20	24 57	46	25
32	35 35	21 57	36 15	22 23	36 56	22 49	37 36	23 15	38 17	23 40	38 57	24 1	39 38	24 1	40 18	24 58	47	26
34	35 33	21 58	36 14	22 24	36 55	22 50	37 35	23 15	38 15	23 41	38 56	24 1	39 37	24 1	40 17	24 58	48	26
36	35 32	21 59	36 13	22 25	36 53	22 50	37 34	23 16	38 14	23 42	38 55	24 1	39 35	24 1	40 15	24 59	49	27
38	35 31	22 0	36 11	22 25	36 52	22 51	37 32	23 17	38 13	23 43	38 53	24 1	39 34	24 1	40 14	25 0	50	27
40	35 29	22 0	36 10	22 26	36 50	22 52	37 31	23 18	38 11	23 43	38 52	24 1	39 32	24 1	40 12	25 0	51	28
42	35 28	22 1	36 9	22 27	36 49	22 53	37 29	23 18	38 10	23 44	38 50	24 1	39 31	24 1	40 11	25 0	52	28
44	35 27	22 1	36 8	22 28	36 48	22 53	37 28	23 19	38 8	23 45	38 49	24 1	39 29	24 1	40 9	25 0	53	29
46	35 26	22 1	36 6	22 28	36 46	22 54	37 27	23 20	38 7	23 46	38 47	24 1	39 28	24 1	40 8	25 0	54	29
48	35 24	22 1	36 5	22 29	36 45	22 55	37 25	23 21	38 5	23 47	38 46	24 1	39 26	24 1	40 6	25 0	55	30
50	35 23	22 1	36 3	22 30	36 43	22 56	37 24	23 21	38 4	23 47	38 44	24 1	39 25	24 1	40 5	25 0	56	30
52	35 22	22 1	36 2	22 31	36 42	22 56	37 22	23 22	38 3	23 48	38 43	24 1	39 23	24 1	40 3	25 0	57	30
54	35 20	22 1	36 0	22 31	36 41	22 57	37 21	23 23	38 1	23 49	38 41	24 1	39 22	24 1	40 2	25 0	58	31
56	35 19	22 1	36 59	22 32	36 39	22 58	37 20	23 24	38 0	23 50	38 40	24 1	39 20	24 1	40 0	25 0	59	31
58	35 18	22 1	36 58	22 33	36 38	22 59	37 18	23 25	37 58	23 50	38 39	24 1	39 19	24 1	40 0	25 0	60	31

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (48° and 49°)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
48°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	35 16	22	8 35	56	22 33	36 37	22 59	37 17	23 25	37 57	23 51	38 37	24 17	39 17	24 43	39 57	25	9
2	35 15	22	8 35	55	22 34	36 35	23	0 37	15	23 26	37 56	23 52	38 36	24 18	39 16	24 44	39 56	25
4	35 13	22	9 35	54	22 35	36 34	23	1 37	14	23 27	37 54	23 53	38 34	24 19	39 14	24 45	39 54	25
6	35 12	22	10 35	52	22 36	36 32	23	2 37	12	23 28	37 53	23 54	38 33	24 19	39 13	24 45	39 53	25
8	35 11	22	10 35	51	22 36	36 31	23	2 37	11	23 28	37 51	23 54	38 31	24 20	39 11	24 46	39 51	25
10	35 9	22	11 35	49	22 37	36 30	23	3 37	10	23 29	37 50	23 55	38 30	24 21	39 10	24 47	39 50	25
12	35 8	22	12 35	48	22 38	36 28	23	4 37	8	23 30	37 48	23 56	38 28	24 22	39 8	24 48	39 48	25
14	35 7	22	13 35	47	22 39	36 27	23	5 37	7	23 31	37 47	23 57	38 27	24 23	39 7	24 49	39 47	25
16	35 5	22	13 35	45	22 39	36 25	23	5 37	5	23 31	37 45	23 57	38 25	24 23	39 5	24 50	39 45	25
18	35 4	22	14 35	44	22 40	36 24	23	6 37	4	23 32	37 44	23 58	38 24	24 24	39 4	24 50	39 44	25
20	35 3	22	15 35	43	22 41	36 22	23	7 37	2	23 33	37 42	23 59	38 22	24 25	39 2	24 51	39 42	25
22	35 1	22	15 35	41	22 42	36 21	23	8 37	1	23 34	37 41	24	0 38	21	24 26	39 0	24 52	39 40
24	35 0	22	16 35	40	22 42	36 20	23	8 37	0	23 34	37 39	24	0 38	19	24 27	38 59	24 53	39 39
26	34 59	22	17 35	38	22 43	36 18	23	9 36	58	23 35	37 38	24	1 38	18	24 27	38 58	24 54	39 37
28	34 57	22	17 35	37	22 44	36 17	23	10 36	57	23 36	37 36	24	2 38	16	24 28	38 56	24 54	39 36
30	34 56	22	18 35	36	22 44	36 15	23	10 36	55	23 37	37 35	24	3 38	15	24 29	38 55	24 55	39 34
32	34 55	22	19 35	34	22 45	36 14	23	11 36	54	23 37	37 34	24	3 38	13	24 30	38 53	24 56	39 33
34	34 53	22	20 35	33	22 46	36 13	23	12 36	52	23 38	37 32	24	4 38	12	24 30	38 52	24 57	39 31
36	34 52	22	20 35	32	22 46	36 11	23	13 36	51	23 39	37 31	24	5 38	10	24 31	38 50	24 57	39 30
38	34 51	22	21 35	30	22 47	36 10	23	13 36	50	23 40	37 29	24	6 38	9	24 32	38 49	24 58	39 28
40	34 49	22	22 35	29	22 48	36 8	23	14 36	48	23 40	37 28	24	6 38	7	24 33	38 47	24 59	39 27
42	34 48	22	22 35	27	22 49	36 7	23	15 36	47	23 41	37 26	24	7 38	6	24 33	38 46	25	0 39
44	34 46	22	23 35	26	22 49	36 6	23	16 36	45	23 42	37 25	24	8 38	4	24 34	38 44	25	0 39
46	34 45	22	24 35	25	22 50	36 4	23	16 36	44	23 43	37 23	24	9 38	3	24 35	38 43	25	1 39
48	34 44	22	25 35	23	22 51	36 3	23	17 36	42	23 43	37 22	24	10 38	2	24 36	38 41	25	2 39
50	34 42	22	25 35	22	22 51	36 1	23	18 36	41	23 44	37 21	24	10 38	0	24 37	38 40	25	3 39
52	34 41	22	26 35	21	22 52	36 0	23	19 36	40	23 45	37 19	24	11 37	59	24 37	38 38	25	4 39
54	34 40	22	27 35	19	22 53	35 59	23	19 36	38	23 46	37 18	24	12 37	57	24 38	38 37	25	4 39
56	34 38	22	27 35	18	22 54	35 57	23	20 36	37	23 46	37 16	24	13 37	56	24 39	38 35	25	5 39
58	34 37	22	28 35	16	22 55	35 56	23	21 36	35	23 47	37 15	24	13 37	54	24 40	38 34	25	6 39
49°	34 36	22	29 35	15	22 55	35 54	23	21 36	34	23 48	37 13	24	13 37	53	24 40	38 32	25	7 39
0'	34 36	22	29 35	14	22 56	35 53	23	22 36	32	23 49	37 12	24	14 37	51	24 41	38 31	25	8 39
2	34 33	22	30 35	12	22 57	35 52	23	23 36	31	23 49	37 10	24	16 37	50	24 42	38 29	25	8 39
4	34 33	22	30 35	12	22 57	35 52	23	23 36	31	23 49	37 10	24	16 37	50	24 42	38 29	25	8 39
6	34 32	22	31 35	11	22 57	35 50	23	24 36	30	23 50	37 9	24	16 37	48	24 43	38 27	25	9 39
8	34 30	22	32 35	9	22 58	35 49	23	24 36	28	23 51	37 7	24	17 37	47	24 43	38 26	25	10 39
10	34 29	22	32 35	8	22 59	35 47	23	25 36	27	23 51	37 6	24	18 37	45	24 44	38 24	25	11 39
12	34 27	22	33 35	7	22 59	35 46	23	26 36	25	23 52	37 4	24	19 37	44	24 45	38 23	25	11 39
14	34 26	22	34 35	5	23 0	35 44	23	27 36	24	23 53	37 3	24	19 37	42	24 46	38 21	25	12 39
16	34 25	22	34 35	4	23 1	35 43	23	27 36	22	23 54	37 1	24	20 37	41	24 46	38 20	25	13 38
18	34 23	22	35 35	2	23 1	35 42	23	28 36	21	23 54	37 0	24	21 37	39	24 47	38 18	25	14 38
20	34 22	22	36 35	1	23 2	35 40	23	29 36	19	23 55	36 58	24	22 37	37	24 48	38 17	25	15 38
22	34 21	22	36 35	0	23 3	35 39	23	29 36	18	23 56	36 57	24	22 37	36	24 49	38 15	25	15 38
24	34 19	22	37 34	58	23	4 35	37	23 30	16	23 57	36 55	24	23 37	34	24 50	38 14	25	16 38
26	34 18	22	38 34	57	23	4 35	36	23 31	15	23 57	36 54	24	24 37	33	24 50	38 12	25	17 38
28	34 16	22	39 34	55	23	5 35	34	23 32	13	23 58	36 52	24	25 37	31	24 51	38 10	25	18 38
30	34 15	22	39 34	54	23	6 35	33	23 32	12	23 59	36 51	24	25 37	30	24 52	38 9	25	18 38
32	34 14	22	40 34	53	23	7 35	32	23 33	11	24 0	36 49	24	26 37	28	24 53	38 7	25	19 38
34	34 12	22	41 34	51	23	7 35	30	23 34	9	24 0	36 48	24	27 37	27	24 53	38 6	25	20 38
36	34 11	22	41 34	50	23	8 35	29	23 34	8	24 1	36 46	24	28 37	25	24 54	38 4	25	21 38
38	34 9	22	42 34	48	23	9 35	27	23 35	6	24 2	36 45	24	28 37	24	24 55	38 3	25	21 38
40	34 8	22	43 34	47	23	9 35	26	23 36	4	24 2	36 43	24	29 37	22	24 56	38 1	25	22 38
42	34 7	22	43 34	46	23	10 35	24	23 37	3	24 3	36 42	24	30 37	21	24 56	38 0	25	23 38
44	34 5	22	44 34	44	23	11 35	23	23 37	2	24 4	36 41	24	31 37	19	24 57	37 58	25	24 38
46	34 4	22	45 34	43	23	12 35	22	23 38	0	24 5	36 39	24	31 37	18	24 58	37 57	25	25 38
48	34 3	22	46 34	41	23	13 35	20	23 39	59	24	5 36	38	32	16	24 59	37 55	25	25 38
50	34 1	22	46 34	40	23	13 35	19	23 40	57	24	6 36	36	34	15	24 59	37 54	25	26 38
52	34 0	22	47 34	39	23	14 35	17	23 40	56	24	7 36	35	34	13	25 0	37 52	25	27 38
54	33 59	22	48 34	37	23	14 35	16	23 41	55	24	8 36	33	34	12	25 1	37 50	25	28 38
56	33 57	22	48 34	36	23	15 35	14	23 42	53	24	8 36	32	34	10	25 2	37 49	25	28 38
58	33 56	22	49 34	34	23	16 35	13	23 42	52	24	9 36	30	34	9	25 2	37 47	25	29 38

(50° and 51°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

Minutes of Moon's Hor. Parallax.

App. Alt.	54'	55'	56'	57'	58'	59'	60'	61'	Seconds of H. P.	A
50°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°
0'	33 54	22 50 34	33 23 16	35 12	23 43 35	50 24 10	36 29 24	36 37 7	25 30 38	24 25 57
2	33 53	22 50 34	32 23 17	35 10	23 44 35	49 24 11	36 27 24	37 37 6	25 31 38	23 25 57
4	33 52	22 51 34	30 23 18	35 9	23 45 35	47 24 11	36 26 24	38 37 4	25 31 38	21 25 58
6	33 50	22 52 34	29 23 19	35 7	23 45 35	46 24 12	36 24 24	39 37 3	25 32 38	20 25 59
8	33 49	22 53 34	27 23 19	35 6	23 46 35	44 24 13	36 23 24	39 37 1	25 33 38	18 26 0
10	33 47	22 53 34	26 23 20	35 4	23 47 35	43 24 13	36 21 24	40 37 0	25 34 38	17 26 0
12	33 46	22 54 34	24 23 21	35 3	23 47 35	41 24 14	36 20 24	41 36 58	25 34 38	15 26 1
14	33 45	22 55 34	23 23 21	35 1	23 48 35	40 24 15	36 18 24	42 36 57	25 35 38	13 26 2
16	33 43	22 55 34	22 23 22	35 0	23 49 35	38 24 16	36 17 24	42 36 55	25 36 38	12 26 3
18	33 42	22 56 34	20 23 23	34 58	23 49 35	37 24 16	36 15 24	43 36 53	25 37 38	10 26 4
20	33 40	22 57 34	19 23 23	34 57	23 50 35	35 24 17	36 14 24	44 36 52	25 37 38	9 26 4
22	33 39	22 57 34	17 23 24	34 56	23 51 35	34 24 18	36 12 24	45 36 50	25 38 38	7 26 5
24	33 38	22 58 34	16 23 25	34 54	23 52 35	32 24 18	36 11 24	45 36 49	25 39 38	5 26 6
26	33 36	22 59 34	14 23 25	34 53	23 52 35	31 24 19	36 9 24	46 36 47	25 40 38	4 26 6
28	33 35	22 59 34	13 23 26	34 51	23 53 35	29 24 20	36 8 24	47 36 46	25 41 38	2 26 7
30	33 33	23 0 34	12 23 27	34 50	23 54 35	28 24 21	36 6 24	47 36 44	25 41 38	1 26 8
32	33 32	23 1 34	10 23 28	34 48	23 54 35	26 24 21	36 5 24	48 36 43	25 42 37	59 26 9
34	33 31	23 1 34	9 23 28	34 47	23 55 35	25 24 22	36 3 24	49 36 41	25 43 37	58 26 10
36	33 29	23 2 34	7 23 29	34 45	23 56 35	24 24 23	36 2 24	50 36 40	25 44 37	56 26 10
38	33 28	23 3 34	6 23 30	34 44	23 57 35	22 24 23	36 0 24	50 36 38	25 45 37	54 26 11
40	33 26	23 3 34	4 23 30	34 43	23 57 35	21 24 24	36 59 24	51 36 37	25 46 37	53 26 12
42	33 25	23 4 34	3 23 31	34 41	23 58 35	19 24 25	36 57 24	52 36 35	25 47 37	51 26 13
44	33 24	23 5 34	2 23 32	34 40	23 59 35	18 24 26	36 56 24	53 36 34	25 48 37	50 26 13
46	33 22	23 6 34	0 23 32	34 38	23 59 35	16 24 26	36 54 24	53 36 32	25 49 37	48 26 14
48	33 21	23 6 34	59 23 33	34 37	24 0 35	15 24 27	36 53 24	54 36 31	25 50 37	47 26 15
50	33 19	23 7 34	57 23 34	34 35	24 1 35	13 24 28	36 51 24	55 36 29	25 51 37	45 26 16
52	33 18	23 8 34	56 23 35	34 34	24 2 35	12 24 29	36 50 24	56 36 28	25 52 37	44 26 17
54	33 17	23 8 34	55 23 35	34 32	24 3 35	10 24 29	36 48 24	56 36 26	25 53 37	42 26 18
56	33 15	23 9 34	53 23 36	34 31	24 4 35	9 24 30	36 47 24	57 36 25	25 54 37	40 26 18
58	33 14	23 10 34	52 23 37	34 29	24 5 35	7 24 31	36 45 24	58 36 23	25 55 37	38 26 19
51°	54'	55'	56'	57'	58'	59'	60'	61'		
0'	33 12	23 10 33	50 23 37	34 28	24 6 35	6 24 31	35 44 24	58 36 21	25 53 36	59 25 53
2	33 11	23 11 33	49 23 38	34 27	24 7 35	4 24 32	35 42 24	59 36 20	25 54 36	58 25 53
4	33 10	23 12 33	47 23 39	34 25	24 8 35	3 24 33	35 41 25	0 36 18	25 55 36	57 25 54
6	33 8	23 13 33	46 23 39	34 24	24 9 35	1 24 34	35 39 25	1 36 17	25 56 36	56 25 55
8	33 7	23 13 33	44 23 40	34 22	24 10 35	0 24 35	35 37 25	1 36 15	25 57 36	55 25 56
10	33 5	23 14 33	43 23 41	34 21	24 11 35	58 24 35	35 36 25	2 36 14	25 58 36	54 25 57
12	33 4	23 14 33	42 23 41	34 19	24 12 35	57 24 36	35 34 25	3 36 12	25 59 36	53 25 57
14	33 3	23 15 33	40 23 42	34 18	24 13 35	56 24 36	35 33 25	4 36 10	26 0 36	52 25 58
16	33 1	23 16 33	39 23 43	34 16	24 14 35	54 24 37	35 31 25	5 36 9	26 1 36	51 25 59
18	33 0	23 16 33	37 23 44	34 15	24 15 35	52 24 38	35 30 25	6 36 7	26 2 36	50 25 59
20	32 58	23 17 33	36 23 44	34 13	24 16 35	51 24 38	35 28 25	7 36 6	26 3 36	49 25 59
22	32 57	23 18 33	34 23 45	34 12	24 17 35	49 24 39	35 27 25	8 36 4	26 4 36	48 25 59
24	32 55	23 18 33	33 23 46	34 10	24 18 35	48 24 40	35 25 25	9 36 3	26 5 36	47 25 59
26	32 54	23 19 33	31 23 46	34 9	24 19 35	46 24 41	35 24 25	10 36 1	26 6 36	46 25 59
28	32 53	23 20 33	30 23 47	34 7	24 20 35	44 24 41	35 22 25	11 36 0	26 7 36	45 25 59
30	32 51	23 20 33	29 23 48	34 6	24 21 35	43 24 42	35 21 25	12 35 58	26 8 36	44 25 59
32	32 50	23 21 33	27 23 48	34 4	24 22 35	42 24 43	35 19 25	13 35 56	26 9 36	43 25 59
34	32 48	23 22 33	26 23 49	34 3	24 23 35	41 24 43	35 18 25	14 35 55	26 10 36	42 25 59
36	32 47	23 23 33	24 23 50	34 2	24 24 35	40 24 44	35 16 25	15 35 53	26 11 36	41 25 59
38	32 46	23 23 33	23 23 50	34 0	24 25 35	39 24 45	35 15 25	16 35 52	26 12 36	40 25 59
40	32 44	23 24 33	21 23 51	33 59	24 26 35	38 24 46	35 13 25	17 35 50	26 13 36	39 25 59
42	32 43	23 24 33	20 23 52	33 57	24 27 35	37 24 47	35 11 25	18 35 48	26 14 36	38 25 59
44	32 41	23 25 33	18 23 52	33 56	24 28 35	36 24 48	35 10 25	19 35 47	26 15 36	37 25 59
46	32 40	23 26 33	17 23 53	33 54	24 29 35	35 24 49	35 8 25	20 35 46	26 16 36	36 25 59
48	32 38	23 27 33	16 23 54	33 53	24 30 35	34 24 50	35 7 25	21 35 44	26 17 36	35 25 59
50	32 37	23 27 33	14 23 54	33 51	24 31 35	33 24 51	35 5 25	22 35 43	26 18 36	34 25 59
52	32 36	23 28 33	13 23 55	33 50	24 32 35	32 24 52	35 4 25	23 35 42	26 19 36	33 25 59
54	32 34	23 29 33	11 23 56	33 48	24 33 35	31 24 53	35 3 25	24 35 41	26 20 36	32 25 59
56	32 33	23 29 33	10 23 56	33 47	24 34 35	30 24 54	35 2 25	25 35 40	26 21 36	31 25 59
58	32 31	23 30 33	8 23 57	33 45	24 35 35	29 24 55	35 1 25	26 35 39	26 22 36	30 25 59

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (52° and 53°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'	55'	56'	57'	58'	59'	60'	61'	"		"		"		"		"	"	"
52°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	1	2	3
0'	32 30	23 30	33 7	23 58	33 44	24 25	34 21	24 53	34 58	25 26	35 35	25 47	36 12	26 15	36 49	26 42	1	1	0
2	32 28	23 31	33 5	23 58	33 42	24 26	34 19	24 53	34 56	25 21	35 33	25 48	36 10	26 16	36 47	26 43	3	2	1
4	32 27	23 32	33 4	23 59	33 41	24 27	34 18	24 54	34 55	25 21	35 32	25 49	36 10	26 16	36 45	26 44	5	3	2
6	32 26	23 32	33 2	24 0	33 39	24 27	34 16	24 55	34 53	25 22	35 30	25 50	36 7	26 17	36 44	26 44	6	4	3
8	32 24	23 33	33 1	24 0	33 38	24 26	34 15	24 55	34 51	25 23	35 28	25 50	36 5	26 18	36 42	26 45	7	5	4
10	32 23	23 34	33 0	24 1	33 36	24 29	34 13	24 56	34 50	25 23	35 27	25 51	36 4	26 18	36 40	26 46	9	5	4
12	32 21	23 34	32 58	24 2	33 35	24 29	34 12	24 57	34 48	25 24	35 25	25 52	36 2	26 19	36 39	26 47	10	6	5
14	32 20	23 35	32 57	24 2	33 33	24 30	34 10	24 57	34 47	25 25	35 24	25 52	36 0	26 20	36 37	26 47	11	7	5
16	32 18	23 35	32 55	24 3	33 32	24 31	34 9	24 58	34 45	25 26	35 22	25 53	35 59	26 21	36 35	26 48	12	7	6
18	32 17	23 36	32 54	24 3	33 30	24 31	34 7	24 59	34 44	25 26	35 20	25 54	35 57	26 21	36 34	26 49	13	8	6
20	32 15	23 37	32 52	24 4	33 29	24 32	34 5	24 59	34 42	25 27	35 19	25 54	35 55	26 22	36 32	26 50	14	8	7
22	32 14	23 37	32 51	24 5	33 27	24 33	34 3	25 0	34 41	25 28	35 17	25 55	35 54	26 23	36 31	26 50	15	9	7
24	32 13	23 38	32 49	24 6	33 26	24 33	34 2	25 1	34 39	25 28	35 16	25 56	35 52	26 23	36 29	26 51	16	10	8
26	32 11	23 39	32 48	24 6	33 24	24 34	34 1	25 1	34 38	25 29	35 15	25 57	35 51	26 24	36 27	26 52	17	11	8
28	32 10	23 39	32 46	24 7	33 23	24 35	33 59	25 2	34 36	25 30	35 13	25 57	35 49	26 25	36 26	26 53	18	11	9
30	32 8	23 40	32 45	24 8	33 21	24 35	33 58	25 3	34 34	25 30	35 11	25 58	35 47	26 26	36 24	26 53	19	12	9
32	32 7	23 41	32 43	24 8	33 20	24 36	33 56	25 4	34 33	25 31	35 9	25 59	35 46	26 26	36 22	26 54	20	12	10
34	32 5	23 41	32 42	24 9	33 18	24 37	33 55	25 5	34 31	25 32	35 8	26 0	35 44	26 27	36 21	26 55	21	13	10
36	32 4	23 42	32 40	24 10	33 17	24 37	33 53	25 6	34 30	25 33	35 6	26 0	35 43	26 28	36 19	26 56	22	14	11
38	32 3	23 43	32 39	24 10	33 15	24 38	33 52	25 6	34 28	25 33	35 5	26 1	35 41	26 29	36 18	26 56	23	14	11
40	32 1	23 43	32 37	24 11	33 14	24 39	33 50	25 6	34 27	25 34	35 3	26 2	35 39	26 29	36 16	26 57	24	15	11
42	32 0	23 44	32 36	24 12	33 12	24 39	33 49	25 7	34 25	25 35	35 2	26 3	35 38	26 30	36 14	26 58	25	15	12
44	31 58	23 45	32 35	24 12	33 11	24 40	33 47	25 8	34 24	25 35	35 0	26 3	35 36	26 31	36 13	26 58	26	16	12
46	31 57	23 45	32 33	24 13	33 9	24 41	33 46	25 8	34 22	25 36	34 58	26 4	35 35	26 31	36 11	26 59	27	16	13
48	31 55	23 46	32 32	24 13	33 8	24 41	33 44	25 9	34 20	25 37	34 57	26 4	35 33	26 32	36 9	27 0	28	17	13
50	31 54	23 47	32 30	24 14	33 6	24 42	33 43	25 10	34 19	25 37	34 55	26 5	35 31	26 33	36 8	27 1	29	17	14
52	31 52	23 47	32 29	24 15	33 5	24 43	33 41	25 10	34 17	25 38	34 54	26 6	35 30	26 34	36 6	27 2	30	18	14
54	31 51	23 48	32 27	24 16	33 3	24 43	33 40	25 11	34 16	25 39	34 52	26 7	35 28	26 34	36 4	27 3	31	19	15
56	31 50	23 49	32 26	24 16	33 2	24 44	33 38	25 12	34 14	25 40	34 50	26 7	35 27	26 35	36 3	27 4	32	20	15
58	31 48	23 49	32 24	24 17	33 0	24 45	33 37	25 13	34 13	25 40	34 49	26 8	35 25	26 36	36 1	27 5	33	21	16
53°	54'	55'	56'	57'	58'	59'	60'	61'											
0'	31 47	23 50	32 23	24 18	32 59	24 45	33 35	25 13	34 11	25 41	34 47	26 9	35 23	26 36	35 59	27 4	41	25	19
2	31 45	23 51	32 21	24 18	32 57	24 46	33 33	25 14	34 10	25 42	34 46	26 9	35 22	26 37	35 58	27 5	42	25	20
4	31 44	23 51	32 20	24 19	32 56	24 47	33 32	25 15	34 8	25 42	34 44	26 10	35 20	26 38	35 56	27 6	43	26	20
6	31 42	23 52	32 18	24 20	32 54	24 47	33 30	25 15	34 6	25 43	34 42	26 11	35 18	26 39	35 55	27 7	44	26	21
8	31 41	23 52	32 17	24 20	32 53	24 48	33 29	25 16	34 5	25 44	34 41	26 11	35 17	26 39	35 53	27 7	45	27	21
10	31 39	23 53	32 15	24 21	32 51	24 49	33 27	25 17	34 3	25 44	34 39	26 12	35 15	26 40	35 51	27 8	46	28	22
12	31 38	23 54	32 14	24 22	32 50	24 49	33 26	25 17	34 2	25 45	34 38	26 13	35 14	26 41	35 50	27 9	47	28	22
14	31 36	23 54	32 12	24 22	32 48	24 50	33 24	25 18	34 0	25 46	34 36	26 14	35 12	26 41	35 48	27 9	48	29	23
16	31 35	23 55	32 11	24 23	32 47	24 51	33 23	25 19	33 59	25 46	34 34	26 14	35 10	26 42	35 46	27 10	49	30	23
18	31 34	23 56	32 9	24 24	32 45	24 51	33 21	25 19	33 57	25 47	34 33	26 15	35 9	26 43	35 45	27 11	50	31	24
20	31 32	23 56	32 8	24 24	32 44	24 52	33 20	25 20	33 55	25 48	34 31	26 16	35 7	26 44	35 43	27 11	51	32	25
22	31 31	23 57	32 6	24 25	32 42	24 53	33 18	25 21	33 54	25 48	34 30	26 16	35 5	26 44	35 41	27 12	52	33	26
24	31 29	23 58	32 5	24 25	32 41	24 53	33 16	25 21	33 52	25 49	34 28	26 17	35 4	26 45	35 40	27 13	53	34	26
26	31 28	23 58	32 3	24 26	32 39	24 54	33 15	25 22	33 51	25 50	34 26	26 18	35 2	26 46	35 38	27 14	54	35	27
28	31 26	23 59	32 2	24 27	32 38	24 55	33 13	25 23	33 49	25 51	34 25	26 18	35 1	26 46	35 36	27 14	55	36	27
30	31 25	23 59	32 0	24 27	32 36	24 55	33 12	25 23	33 47	25 51	34 23	26 19	34 59	26 47	35 35	27 15	56	37	27
32	31 23	24 0	31 59	24 28	32 35	24 56	33 10	25 24	33 46	25 52	34 22	26 20	34 57	26 48	35 33	27 16	57	38	28
34	31 22	24 1	31 57	24 29	32 33	24 57	33 9	25 25	33 44	25 53	34 20	26 21	34 56	26 48	35 31	27 16	58	39	28
36	31 20	24 1	31 56	24 30	32 32	24 57	33 7	25 25	33 43	25 53	34 18	26 21	34 54	26 49	35 30	27 17	59	40	29
38	31 19	24 2	31 54	24 30	32 30	24 58	33 6	25 26	33 41	25 54	34 17	26 22	34 52	26 50	35 28	27 18	60	41	30
40	31 17	24 3	31 53	24 31	32 28	24 59	33 4	25 27	33 40	25 55	34 15	26 23	34 51	26 51	35 26	27 19	61	42	31
42	31 16	24 3	31 51	24 31	32 27	24 59	33 3	25 27	33 38	25 55	34 14	26 23	34 49	26 51	35 25	27 19	62	43	32
44	31 14	24 4	31 50	24 32	32 25	25 0	33 1	25 28	33 36	25 56	34 12	26 24	34 47	26 52	35 23	27 20	63	44	33
46	31 13	24 5	31 48	24 33	32 24	25 0	32 59	25 29	33 35	25 57	34 10	26 25	34 46	26 53	35 21	27 21	64	45	34
48	31 12	24 5	31 47	24 34	32 22	25 1	32 58	25 29	33 33	25 57	34 9	26 25	34 44	26 53	35 20	27 21	65	46	35
50	31 10	24 6	31 45	24 34	32 21	25 1	32 56	25 30	33 32	25 58	34 7	26 26	34 43	26 54	35 18	27 22	66	47	36
52	31 9	24 6	31 44	24 35	32 19	25 1	32 55	25 31	33 30	25 59	34 6	26 27	34 41	26 55	35 16	27 23	67	48	37
54	31 7	24 7	31 43	24 35	32 18	25 1	32 53	25 31	33 29	25 59	34 4	26 27	34 39	26 56	35 15	27 24	68	49	38
56	31 6	24 8	31 41	24 36	32 16	25 2	32 52	25 32	33 27	26 0	34 3	26 28	34 38	26 56	35 13	27 24	69	50	39
58	31 4	24 8	31 40	24 37	32 15	25 2	32 50	25 33	33 25	26 1	34 2	26 29	34 36	26 57	35 11	27 25	70	51	40

(54° and 55°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
54°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	31	324	9	31	38	24	37	32	13	25	5	32	49	25	33	33	24	26
2	31	124	10	31	37	24	38	32	12	25	6	32	47	25	34	33	22	26
4	31	0	24	10	31	35	24	38	32	10	25	7	32	45	25	35	33	21
6	30	58	24	11	31	34	24	39	32	9	25	7	32	44	25	35	33	19
8	30	57	24	12	31	32	24	40	32	7	25	8	32	42	25	36	33	17
10	30	55	24	12	31	30	24	40	32	6	25	8	32	41	25	37	33	16
12	30	54	24	13	31	29	24	41	32	4	25	9	32	39	25	37	33	14
14	30	52	24	13	31	27	24	42	32	3	25	10	32	38	25	38	33	13
16	30	51	24	14	31	26	24	42	32	1	25	10	32	36	25	39	33	11
18	30	49	24	15	31	24	24	43	31	59	25	11	32	34	25	39	33	9
20	30	48	24	15	31	23	24	43	31	58	25	12	32	33	25	40	33	8
22	30	46	24	16	31	21	24	44	31	56	25	12	32	31	25	41	33	6
24	30	45	24	17	31	20	24	45	31	55	25	13	32	30	25	41	33	5
26	30	43	24	17	31	18	24	45	31	53	25	14	32	28	25	42	33	3
28	30	42	24	18	31	17	24	46	31	52	25	14	32	27	25	42	33	2
30	30	40	24	18	31	15	24	47	31	50	25	15	32	25	25	43	33	0
32	30	39	24	19	31	14	24	47	31	49	25	16	32	23	25	44	33	0
34	30	37	24	20	31	12	24	48	31	47	25	16	32	22	25	44	33	0
36	30	36	24	20	31	11	24	48	31	45	25	17	32	20	25	45	33	0
38	30	34	24	21	31	9	24	49	31	44	25	17	32	19	25	46	33	0
40	30	33	24	21	31	8	24	50	31	42	25	18	32	17	25	46	33	0
42	30	32	24	22	31	6	24	50	31	41	25	19	32	16	25	47	33	0
44	30	30	24	23	31	5	24	51	31	39	25	19	32	14	25	48	33	0
46	30	29	24	23	31	3	24	52	31	38	25	20	32	12	25	48	33	0
48	30	27	24	24	31	2	24	52	31	36	25	21	32	11	25	49	33	0
50	30	26	24	24	31	0	24	53	31	35	25	21	32	9	25	50	33	0
52	30	24	24	25	30	59	24	54	31	33	25	22	32	8	25	50	33	0
54	30	23	24	26	30	57	24	54	31	32	25	23	32	6	25	51	33	0
56	30	21	24	26	30	56	24	55	31	30	25	23	32	5	25	52	33	0
58	30	20	24	27	30	54	24	55	31	29	25	24	32	3	25	52	33	0
55°	54'		55'		56'		57'		58'		59'		60'		61'		39	22
0'	30	18	24	26	30	52	24	56	31	27	25	24	32	1	25	53	32	36
2	30	17	24	28	30	51	24	57	31	25	25	25	32	0	25	54	32	34
4	30	15	24	29	30	49	24	57	31	24	25	26	31	58	25	54	32	33
6	30	14	24	29	30	48	24	58	31	22	25	26	31	57	25	55	32	31
8	30	12	24	30	30	46	24	59	31	21	25	27	31	55	25	56	32	29
10	30	11	24	31	30	45	24	59	31	19	25	28	31	53	25	56	32	28
12	30	9	24	31	30	43	25	0	31	18	25	28	31	52	25	57	32	26
14	30	8	24	32	30	42	25	0	31	16	25	29	31	50	25	57	32	24
16	30	6	24	32	30	40	25	1	31	15	25	30	31	49	25	58	32	23
18	30	5	24	33	30	39	25	2	31	13	25	30	31	47	25	59	32	21
20	30	3	24	34	30	37	25	2	31	11	25	31	31	45	25	59	32	20
22	30	2	24	34	30	36	25	3	31	10	25	31	31	44	26	0	32	18
24	30	0	24	35	30	34	25	4	31	8	25	32	31	42	26	1	32	16
26	29	59	24	35	30	33	25	4	31	7	25	33	31	41	26	1	32	15
28	29	57	24	36	30	31	25	5	31	5	25	33	31	39	26	2	32	13
30	29	56	24	37	30	30	25	5	31	4	25	34	31	38	26	3	32	11
32	29	54	24	37	30	28	25	6	31	2	25	35	31	36	26	3	32	10
34	29	53	24	38	30	26	25	7	31	0	25	35	31	34	26	4	32	8
36	29	51	24	38	30	25	25	7	30	59	25	36	31	33	26	5	32	6
38	29	50	24	39	30	23	25	8	30	57	25	36	31	31	26	5	32	5
40	29	48	24	40	30	22	25	8	30	56	25	37	31	30	26	6	32	3
42	29	46	24	40	30	20	25	9	30	54	25	38	31	28	26	6	32	2
44	29	45	24	41	30	19	25	10	30	53	25	38	31	26	26	7	32	0
46	29	43	24	42	30	17	25	10	30	51	25	39	31	25	26	8	31	59
48	29	42	24	42	30	16	25	11	30	49	25	40	31	23	26	8	31	57
50	29	40	24	43	30	14	25	11	30	48	25	40	31	22	26	9	31	55
52	29	39	24	43	30	13	25	12	30	46	25	41	31	20	26	10	31	54
54	29	37	24	44	30	11	25	13	30	45	25	42	31	18	26	10	31	52
56	29	36	24	45	30	10	25	13	30	43	25	42	31	17	26	11	31	50
58	29	34	24	45	30	8	25	14	30	42	25	43	31	15	26	12	31	49

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (56° and 57°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	A
56°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	A
0'	29 33	24 46	30 7	25 15	30 40	25 43	31 14	26 12	31 47	26 41	32 21	27 10	32 54	27 38	33 28	28 7	1	0
2	29 31	24 46	30 5	25 15	30 39	25 44	31 12	26 13	31 46	26 42	32 19	27 10	32 53	27 39	33 26	28 8	2	1
4	29 30	24 47	30 3	25 16	30 37	25 45	31 10	26 13	31 44	26 42	32 17	27 11	32 51	27 40	33 24	28 9	3	2
6	29 28	24 48	30 2	25 16	30 35	25 45	31 9	26 14	31 42	26 43	32 16	27 12	32 49	27 40	33 23	28 9	4	3
8	29 27	24 48	30 0	25 17	30 34	25 46	31 7	26 15	31 41	26 43	32 14	27 12	32 48	27 41	33 21	28 10	5	4
10	29 25	24 49	29 59	25 18	30 32	25 46	31 6	26 15	31 39	26 44	32 12	27 13	32 46	27 42	33 19	28 11	6	5
12	29 24	24 49	29 57	25 18	30 31	25 47	31 4	26 16	31 37	26 45	32 11	27 14	32 44	27 42	33 18	28 11	7	6
14	29 22	24 50	29 56	25 19	30 29	25 48	31 2	26 17	31 36	26 45	32 9	27 14	32 42	27 43	33 16	28 12	8	7
16	29 21	24 51	29 54	25 19	30 27	25 48	31 1	26 17	31 34	26 46	32 7	27 15	32 41	27 44	33 14	28 13	9	8
18	29 19	24 51	29 53	25 20	30 26	25 49	30 59	26 18	31 33	26 47	32 6	27 16	32 39	27 44	33 12	28 13	10	9
20	29 18	24 52	29 51	25 21	30 24	25 49	30 58	26 18	31 31	26 47	32 4	27 16	32 37	27 45	33 11	28 14	11	10
22	29 16	24 52	29 50	25 21	30 23	25 50	30 56	26 19	31 29	26 48	32 2	27 17	32 36	27 46	33 9	28 15	12	11
24	29 15	24 53	29 48	25 22	30 21	25 51	30 54	26 20	31 28	26 49	32 0	27 17	32 34	27 46	33 7	28 15	13	12
26	29 13	24 53	29 46	25 22	30 20	25 51	30 53	26 20	31 26	26 49	31 59	27 18	32 32	27 47	33 6	28 16	14	13
28	29 12	24 54	29 45	25 23	30 18	25 52	30 51	26 21	31 24	26 50	31 57	27 19	32 31	27 48	33 4	28 17	15	14
30	29 10	24 55	29 43	25 24	30 16	25 53	30 50	26 22	31 23	26 50	31 56	27 19	32 29	27 48	33 2	28 17	16	15
32	29 9	24 55	29 42	25 24	30 15	25 53	30 48	26 22	31 21	26 51	31 54	27 20	32 27	27 49	33 0	28 18	17	16
34	29 7	24 56	29 40	25 25	30 13	25 54	30 46	26 23	31 19	26 52	31 52	27 21	32 25	27 50	32 59	28 19	18	17
36	29 6	24 56	29 39	25 25	30 12	25 54	30 45	26 23	31 18	26 52	31 51	27 21	32 24	27 50	32 57	28 19	19	18
38	29 4	24 57	29 37	25 26	30 10	25 55	30 43	26 24	31 16	26 53	31 49	27 22	32 22	27 51	32 55	28 20	20	19
40	29 2	24 58	29 35	25 27	30 8	25 56	30 41	26 25	31 14	26 54	31 47	27 23	32 20	27 52	32 53	28 21	21	20
42	29 1	24 58	29 34	25 27	30 7	25 56	30 40	26 25	31 13	26 54	31 46	27 23	32 19	27 52	32 52	28 21	22	21
44	28 59	24 59	29 32	25 28	30 5	25 57	30 38	26 26	31 11	26 55	31 44	27 24	32 17	27 53	32 50	28 22	23	22
46	28 58	24 59	29 31	25 28	30 4	25 58	30 37	26 27	31 10	26 56	31 42	27 25	32 15	27 54	32 48	28 23	24	23
48	28 56	25 0	29 29	25 29	30 2	25 58	30 35	26 27	31 8	26 56	31 41	27 25	32 14	27 54	32 47	28 23	25	24
50	28 55	25 0	29 28	25 30	30 1	25 59	30 33	26 28	31 6	26 57	31 39	27 26	32 12	27 55	32 45	28 24	26	25
52	28 53	25 1	29 26	25 30	29 59	25 59	30 32	26 28	31 5	26 57	31 37	27 26	32 10	27 56	32 43	28 25	27	26
54	28 52	25 2	29 25	25 31	29 57	26 0	30 30	26 29	31 3	26 58	31 36	27 27	32 9	27 56	32 41	28 25	28	27
56	28 50	25 3	29 23	25 31	29 56	26 1	30 29	26 30	31 1	26 59	31 34	27 28	32 7	27 57	32 40	28 26	29	28
58	28 49	25 3	29 22	25 32	29 54	26 1	30 27	26 30	31 0	26 59	31 32	27 28	32 5	27 58	32 38	28 27	30	29
57°	54'	55'	56'	57'	58'	59'	60'	61'										
0'	28 47	25 4	29 20	25 33	29 53	26 2	30 25	26 31	30 58	27 0	31 31	27 29	32 3	27 58	32 36	28 27	41	23
2	28 46	25 5	29 18	25 33	29 51	26 2	30 24	26 32	30 56	27 1	31 29	27 30	32 2	27 59	32 34	28 28	42	23
4	28 44	25 5	29 17	25 34	29 49	26 3	30 22	26 32	30 55	27 1	31 27	27 30	32 0	27 59	32 33	28 29	43	24
6	28 43	25 5	29 15	25 34	29 48	26 4	30 21	26 33	30 53	27 1	31 26	27 31	31 58	28 0	32 31	28 29	44	24
8	28 41	25 6	29 14	25 35	29 46	26 4	30 19	26 33	30 51	27 2	31 24	27 32	31 57	28 1	32 29	28 30	45	25
10	28 40	25 6	29 12	25 36	29 45	26 5	30 17	26 34	30 50	27 3	31 22	27 32	31 55	28 1	32 27	28 31	46	25
12	28 38	25 7	29 11	25 36	29 43	26 5	30 16	26 35	30 48	27 4	31 21	27 33	31 53	28 2	32 26	28 31	47	26
14	28 37	25 8	29 9	25 37	29 41	26 6	30 14	26 35	30 46	27 4	31 19	27 34	31 51	28 2	32 24	28 32	48	26
16	28 35	25 8	29 7	25 37	29 40	26 7	30 12	26 36	30 45	27 5	31 17	27 34	31 50	28 3	32 22	28 33	49	27
18	28 33	25 9	29 6	25 38	29 38	26 7	30 11	26 36	30 43	27 6	31 16	27 35	31 48	28 3	32 20	28 33	50	28
20	28 32	25 9	29 4	25 38	29 37	26 8	30 9	26 37	30 41	27 6	31 14	27 35	31 46	28 3	32 19	28 34	51	29
22	28 30	25 10	29 3	25 39	29 35	26 8	30 7	26 38	30 40	27 7	31 12	27 36	31 45	28 3	32 17	28 35	52	30
24	28 29	25 10	29 1	25 40	29 33	26 9	30 6	26 38	30 38	27 7	31 10	27 37	31 43	28 3	32 15	28 35	53	31
26	28 27	25 11	28 59	25 40	29 32	26 10	30 4	26 39	30 36	27 8	31 9	27 37	31 41	28 3	32 13	28 36	54	32
28	28 26	25 12	28 58	25 41	29 30	26 10	30 3	26 39	30 35	27 9	31 7	27 38	31 39	28 3	32 12	28 36	55	32
30	28 24	25 12	28 56	25 41	29 29	26 11	30 1	26 40	30 33	27 9	31 5	27 38	31 38	28 3	32 10	28 37	56	33
32	28 23	25 13	28 55	25 42	29 27	26 11	29 59	26 41	30 31	27 10	31 4	27 39	31 36	28 3	32 8	28 38	57	34
34	28 21	25 13	28 53	25 43	29 25	26 12	29 58	26 41	30 30	27 10	31 3	27 40	31 34	28 3	32 6	28 38	58	35
36	28 19	25 14	28 52	25 43	29 24	26 13	29 56	26 42	30 28	27 11	31 1	27 40	31 32	28 3	32 5	28 39	59	36
38	28 18	25 15	28 50	25 44	29 22	26 13	29 54	26 42	30 26	27 12	30 59	27 41	31 31	28 3	32 4	28 40	60	37
40	28 16	25 15	28 48	25 44	29 21	26 14	29 53	26 43	30 25	27 13	30 57	27 42	31 29	28 3	32 3	28 40	61	38
42	28 15	25 16	28 47	25 45	29 19	26 14	29 51	26 44	30 23	27 13	30 55	27 42	31 27	28 3	32 2	28 41	62	39
44	28 13	25 16	28 45	25 46	29 17	26 15	29 49	26 44	30 21	27 14	30 54	27 43	31 26	28 3	32 1	28 42	63	40
46	28 12	25 17	28 44	25 46	29 16	26 15	29 48	26 45	30 20	27 14	30 52	27 43	31 24	28 3	32 1	28 42	64	41
48	28 10	25 17	28 42	25 47	29 14	26 16	29 46	26 45	30 18	27 15	30 50	27 44	31 22	28 3	32 1	28 43	65	42
50	28 9	25 18	28 41	25 47	29 13	26 17	29 45	26 46	30 16	27 15	30 48	27 45	31 20	28 3	32 1	28 44	66	43
52	28 7	25 19	28 39	25 48	29 11	26 17	29 43	26 47	30 15	27 16	30 47	27 45	31 19	28 3	32 1	28 44	67	44
54	28 6	25 19	28 38	25 48	29 9	26 18	29 41	26 47	30 13	27 17	30 45	27 46	31 17	28 3	32 1	28 45	68	45
56	28 4	25 20	28 36	25 49	29 8	26 18	29 40	26 48	30 12	27 17	30 43	27 47	31 15	28 3	32 1	28 45	69	46
58	28 3	25 20	28 34	25 50	29 6	26 19	29 38	26 48	30 10	27 18	30 42	27 47	31 14	28 3	32 1	28 46	70	47

(58° and 59°) The Correction of the Moon's Altitude, and the Aux. Angle A.																		(w.)																		
Minutes of Moon's Hor. Parallax.																		Seconds of H. P.																		
App. Alt.	54'		55'		56'		57'		58'		59'		60'		61'		"	Cor.	A																	
58°	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A																				
	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°																				
0'	28	1	25	21	28	33	25	50	29	5	26	20	29	36	26	49	30	8	27	18	30	40	27	48	31	12	28	17	31	44	28	47	1	1	0	
2	27	59	25	21	28	31	25	51	29	3	26	20	29	35	26	50	30	7	27	19	30	38	27	49	31	10	28	18	31	42	28	47	2	1	1	
4	27	58	25	22	28	30	25	51	29	1	26	21	29	33	26	50	30	5	27	20	30	37	27	49	31	8	28	19	31	40	28	48	3	2	2	
6	27	56	25	22	28	28	25	52	29	0	26	21	29	31	26	51	30	3	27	20	30	35	27	50	31	7	28	19	31	38	28	49	4	3	3	
8	7	55	25	23	28	26	25	52	28	58	0	26	22	29	30	26	51	30	1	27	21	30	33	27	50	31	5	28	20	31	37	28	49	5	4	4
10	27	53	25	24	28	25	25	53	28	56	26	23	29	28	26	52	30	0	27	21	30	31	27	51	31	3	28	20	31	35	28	50	6	5	5	
12	27	52	25	24	28	23	25	54	28	55	26	23	29	26	26	53	29	58	27	22	30	30	27	52	31	1	28	21	31	33	28	51	7	6	6	
14	27	50	25	25	28	22	25	54	28	53	26	24	29	25	26	53	29	56	27	23	30	28	27	52	31	0	28	22	31	31	28	51	8	7	7	
16	27	49	25	25	28	20	25	55	28	52	26	24	29	23	26	54	29	55	27	23	30	26	27	53	30	58	28	22	31	30	28	52	9	8	8	
18	27	47	25	26	28	18	25	55	28	50	26	25	29	22	26	54	29	53	27	24	30	25	27	53	30	56	28	23	31	28	28	52	10	9	9	
20	27	45	25	26	28	17	25	56	28	48	26	25	29	20	26	55	29	51	27	24	30	23	27	54	30	54	28	24	31	26	28	53	11	10	10	
22	27	44	25	27	28	15	25	56	28	47	26	26	29	18	26	56	29	50	27	25	30	21	27	55	30	53	28	24	31	24	28	54	12	11	11	
24	27	42	25	28	28	14	25	57	28	45	26	27	29	17	26	56	29	48	27	26	30	19	27	55	30	51	28	25	31	22	28	54	13	12	12	
26	27	41	25	28	28	12	25	58	28	44	26	27	29	15	26	57	29	46	27	26	30	18	27	56	30	49	28	25	31	21	28	55	14	13	13	
28	27	39	25	29	28	11	25	58	28	42	26	28	29	13	26	57	29	45	27	27	30	16	27	56	30	47	28	26	31	21	28	56	15	14	14	
30	27	38	25	29	28	9	25	59	28	40	26	28	29	12	26	58	29	43	27	27	30	14	27	57	30	46	28	27	31	17	28	56	16	15	15	
32	27	36	25	30	28	7	25	59	28	39	26	29	29	10	26	59	29	41	27	28	30	13	27	58	30	44	28	27	31	15	28	57	17	16	16	
34	27	34	25	30	28	6	26	0	28	37	26	30	29	8	26	59	29	40	27	29	30	11	27	58	30	42	28	28	31	14	28	57	18	17	17	
36	27	33	25	31	28	4	26	0	28	35	26	30	29	7	27	0	29	38	27	29	30	9	27	59	30	40	28	29	31	12	28	58	19	18	18	
38	27	31	25	31	28	3	26	1	28	34	26	31	29	5	27	0	29	36	27	30	30	8	27	59	30	39	28	29	31	10	28	59	20	19	19	
40	27	30	25	32	28	1	26	2	28	32	26	31	29	3	27	1	29	35	27	30	30	6	28	0	30	37	28	30	31	8	28	59	21	20	20	
42	27	28	25	33	27	59	26	2	28	31	26	32	29	2	27	1	29	33	27	31	30	4	28	1	30	35	28	30	31	7	29	0	28	14	21	21
44	27	27	25	33	27	58	26	3	28	29	26	32	29	0	27	2	29	31	27	32	30	2	28	1	30	34	28	31	31	5	29	1	29	15	22	
46	27	25	25	34	27	56	26	3	28	27	26	33	28	58	27	3	29	30	27	32	30	1	28	2	30	32	28	32	31	3	29	1	31	16	23	
48	27	24	25	34	27	55	26	4	28	26	26	34	28	57	27	3	29	28	27	33	29	59	28	3	30	30	28	32	31	1	29	2	32	16	24	
50	27	22	25	35	27	53	26	4	28	24	26	34	28	55	27	4	29	26	27	33	29	57	28	3	30	28	33	30	59	29	3	33	17	25		
52	27	20	25	35	27	51	26	5	28	22	26	35	28	53	27	4	29	25	27	34	29	56	28	4	30	27	28	34	30	58	29	3	34	17	26	
54	27	19	25	36	27	50	26	6	28	21	26	35	28	52	27	5	29	23	27	35	29	54	28	4	30	25	28	34	30	56	29	4	36	18	27	
56	27	17	25	36	27	48	26	6	28	19	26	36	28	50	27	6	29	21	27	35	29	52	28	5	30	23	28	35	30	54	29	4	37	18	28	
58	27	16	25	37	27	47	26	7	28	18	26	37	28	49	27	6	29	19	27	36	29	50	28	6	30	21	28	35	30	52	29	5	38	19	29	
59°	54'		55'		56'		57'		58'		59'		60'		61'																					
0'	27	14	25	38	27	45	26	7	28	16	26	37	28	47	27	7	29	18	27	36	29	49	28	6	30	20	28	36	30	51	29	6	41	21	20	
2	27	13	25	38	27	43	26	8	28	14	26	38	28	45	27	7	29	16	27	37	29	47	28	7	30	18	28	37	30	49	29	6	42	21	21	
4	27	11	25	39	27	42	26	8	28	13	26	38	28	44	27	8	29	14	27	38	29	45	28	7	30	16	28	37	30	47	29	7	44	22	21	
6	27	9	25	39	27	40	26	9	28	11	26	39	28	42	27	9	29	13	27	38	29	44	28	8	30	14	28	38	30	45	29	7	45	23	22	
8	27	8	25	40	27	39	26	9	28	9	26	39	28	40	27	9	29	11	27	39	29	42	28	9	30	13	28	38	30	43	29	8	46	23	23	
10	27	6	25	40	27	37	26	10	28	8	26	40	28	39	27	10	29	9	27	39	29	40	28	9	30	11	28	39	30	42	29	8	47	24	24	
12	27	5	25	41	27	35	26	11	28	6	26	40	28	37	27	10	29	8	27	40	29	38	28	10	30	9	28	40	30	40	29	9	48	24	25	
14	27	3	25	41	27	34	26	11	28	5	26	41	28	35	27	11	29	6	27	41	29	37	28	10	30	7	28	40	30	38	29	9	50	25	26	
16	27	2	25	42	27	32	26	12	28	3	26	42	28	34	27	11	29	4	27	41	29	35	28	11	30	6	28	41	30	36	29	10	51	26	27	
18	27	0	25	42	27	31	26	12	28	1	26	42	28	32	27	12	29	3	27	42	29	33	28	12	30	4	28	41	30	34	29	11	52	26	28	
20	26	58	25	43	27	29	26	13	28	0	26	43	28	30	27	12	29	1	27	42	29	31	28	12	30	2	28	42	30	33	12	53	27	29		
22	26	57	25	44	27	27	26	13	27	58	26	43	28	29	27	13	28	59	27	43	29	30	28	13	30	0	28	43	30	31	12	54	27	30		
24	26	55	25	44	27	26	26	14	27	56	26	44	28	27	27	14	28	57	27	43	29	28	13	29	58	28	43	30	29	13	55	28	31	31		
26	26	54	25	45	27	24	26	14	27	55	26	44	28	25	27	14	28	56	27	44	29	26	14	29	57	28	44	30	27	14	56	29	32	32		
28	26	52	25	45	27	23	26	15	27	53	26	45	28	24	27	15	28	54	27	45	29	25	28	14	29	55	28	44	30	26	14	57	29	33		
30	26	51	25	46	27	21	26	16	27	51	26	45	28	22	27	15	28	52	27	45	29	23	28	15	29	53	28	45	30	24	15	58	30	34		
32	26	49	25	46	27	19	26	16	27	50	26	46	28	20	27	16	28	51	27	46	29	21	28	16	29	51	28	45</								

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (60° and 61°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									"	A
60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	A
0'	26 27	25 54	26 57	26 24	27 27	26 54	27 57	27 24	28 27	27 54	28 57	28 24	29 27	28 54	29 57	29 24	1	0
2	26 25	25 54	26 55	26 24	27 25	26 54	27 55	27 25	28 25	27 54	28 55	28 25	29 25	28 55	29 55	29 25	2	1
4	26 24	25 55	26 54	26 25	27 24	26 55	27 54	27 25	28 23	27 55	28 53	28 25	29 23	28 55	29 53	29 25	3	1
6	26 22	25 55	26 52	26 25	27 22	26 55	27 52	27 26	28 22	27 56	28 52	28 26	29 22	28 56	29 51	29 26	4	2
8	26 20	25 56	26 50	26 26	27 20	26 56	27 50	27 26	28 20	27 56	28 50	28 26	29 20	28 56	29 50	29 26	5	2
10	26 19	25 57	26 49	26 26	27 19	26 56	27 48	27 27	28 18	27 57	28 48	28 27	29 18	28 57	29 48	29 27	6	3
12	26 17	25 57	26 47	26 27	27 17	26 57	27 47	27 27	28 17	27 57	28 46	28 27	29 16	28 57	29 46	29 28	7	3
14	26 16	25 58	26 45	26 28	27 15	26 57	27 45	27 28	28 15	27 58	28 45	28 28	29 14	28 58	29 44	29 28	8	4
16	26 14	25 58	26 44	26 28	27 14	26 58	27 43	27 28	28 13	27 58	28 43	28 28	29 13	28 58	29 42	29 29	9	4
18	26 12	25 59	26 42	26 29	27 12	26 58	27 42	27 29	28 11	27 59	28 41	28 29	29 11	28 59	29 41	29 29	10	5
20	26 11	25 59	26 41	26 29	27 10	26 59	27 40	27 29	28 10	27 59	28 39	28 29	29 9	28 59	29 39	29 30	11	5
22	26 9	26 0	26 39	26 30	27 9	27 0	27 38	27 30	28 8	28 0	28 38	28 30	29 7	28 59	29 37	29 31	12	6
24	26 8	26 0	26 37	26 30	27 7	27 0	27 37	27 30	28 6	28 0	28 36	28 31	29 6	28 59	29 35	29 31	13	6
26	26 6	26 1	26 36	26 31	27 5	27 0	27 35	27 31	28 5	28 1	28 34	28 31	29 4	28 59	29 33	29 32	14	7
28	26 4	26 1	26 34	26 31	27 4	27 0	27 33	27 32	28 3	28 0	28 32	28 32	29 2	28 59	29 32	29 32	15	7
30	26 3	26 2	26 32	26 32	27 2	27 0	27 32	27 32	28 1	28 0	28 31	28 32	29 0	28 59	29 30	29 33	16	8
32	26 1	26 2	26 31	26 32	27 0	27 0	27 30	27 33	27 59	28 3	28 29	28 33	28 58	28 59	29 29	29 34	17	8
34	26 0	26 2	26 29	26 33	26 59	27 3	27 28	27 33	27 58	28 3	28 27	28 34	28 57	28 59	29 28	29 34	18	9
36	25 58	26 3	26 28	26 33	26 57	27 4	27 26	27 34	27 56	28 4	28 25	28 34	28 55	28 59	29 27	29 35	19	10
38	25 56	26 4	26 26	26 34	26 55	27 4	27 25	27 34	27 54	28 5	28 24	28 35	28 53	28 59	29 25	29 35	20	10
40	25 55	26 4	26 24	26 35	26 54	27 5	27 23	27 35	27 52	28 5	28 22	28 35	28 51	28 59	29 24	29 36	21	11
42	25 53	26 5	26 23	26 35	26 52	27 5	27 21	27 36	27 51	28 6	28 20	28 36	28 50	28 59	29 23	29 36	22	11
44	25 52	26 5	26 21	26 36	26 50	27 6	27 20	27 36	27 49	28 6	28 18	28 37	28 48	28 59	29 22	29 37	23	11
46	25 50	26 6	26 19	26 36	26 49	27 6	27 18	27 37	27 47	28 7	28 17	28 37	28 46	28 59	29 21	29 38	24	12
48	25 48	26 7	26 18	26 37	26 47	27 7	27 16	27 37	27 46	28 7	28 15	28 38	28 44	28 59	29 20	29 38	25	12
50	25 47	26 7	26 16	26 37	26 45	27 8	27 15	27 38	27 44	28 8	28 13	28 38	28 42	28 59	29 19	29 39	26	13
52	25 45	26 8	26 15	26 38	26 44	27 8	27 13	27 38	27 42	28 9	28 11	28 39	28 41	28 59	29 18	29 39	27	13
54	25 44	26 8	26 13	26 38	26 42	27 9	27 11	27 39	27 40	28 9	28 10	28 39	28 39	28 59	29 17	29 40	28	14
56	25 42	26 9	26 11	26 39	26 40	27 9	27 10	27 39	27 39	28 10	28 8	28 40	28 37	28 59	29 16	29 41	29	14
58	25 40	26 9	26 10	26 39	26 39	27 10	27 8	27 40	27 37	28 10	28 6	28 41	28 36	28 59	29 15	29 41	30	15
61°	54'	55'	56'	57'	58'	59'	60'	61'									31	15
0'	25 39	26 10	26 8	26 40	26 37	27 10	27 6	27 41	27 35	28 11	28 4	28 41	28 33	29 11	29 3	29 42	31	16
2	25 37	26 10	26 6	26 41	26 35	27 11	27 4	27 41	27 34	28 11	28 3	28 42	28 32	29 12	29 1	29 42	32	16
4	25 36	26 11	26 5	26 41	26 34	27 11	27 3	27 42	27 32	28 12	28 0	28 42	28 30	29 13	28 59	29 43	33	17
6	25 34	26 11	26 3	26 42	26 32	27 12	27 1	27 42	27 30	28 13	27 59	28 43	28 28	29 13	28 57	29 44	34	17
8	25 32	26 12	26 1	26 42	26 30	27 12	26 59	27 43	27 28	28 13	27 57	28 43	28 26	29 14	28 55	29 44	35	18
10	25 31	26 12	26 0	26 43	26 29	27 13	26 58	27 43	27 27	28 14	27 56	28 44	28 24	29 14	28 53	29 45	36	18
12	25 29	26 13	25 58	26 43	26 27	27 13	26 56	27 44	27 25	28 14	27 54	28 44	28 23	29 15	28 52	29 45	37	19
14	25 28	26 13	25 56	26 44	26 25	27 14	26 54	27 44	27 23	28 15	27 52	28 45	28 21	29 15	28 50	29 46	38	19
16	25 26	26 14	25 55	26 44	26 24	27 15	26 53	27 45	27 21	28 15	27 50	28 46	28 19	29 16	28 48	29 46	39	20
18	25 24	26 14	25 53	26 45	26 22	27 15	26 51	27 45	27 20	28 16	27 48	28 46	28 17	29 17	28 46	29 47	40	20
20	25 23	26 15	25 51	26 45	26 20	27 16	26 49	27 46	27 18	28 16	27 47	28 47	28 16	29 17	28 44	29 47	41	21
22	25 21	26 15	25 50	26 46	26 19	27 16	26 47	27 47	27 16	28 17	27 45	28 47	28 14	29 18	28 42	29 48	42	21
24	25 19	26 16	25 48	26 46	26 17	27 17	26 46	27 47	27 14	28 17	27 43	28 48	28 12	29 18	28 41	29 49	43	22
26	25 18	26 16	25 47	26 47	26 17	27 17	26 44	27 48	27 13	28 18	27 41	28 48	28 10	29 19	28 39	29 49	44	22
28	25 16	26 17	25 45	26 47	26 14	27 18	26 42	27 48	27 11	28 18	27 40	28 49	28 8	29 19	28 37	29 50	45	23
30	25 15	26 17	25 43	26 48	26 12	27 18	26 41	27 49	27 9	28 19	27 38	28 49	28 6	29 20	28 35	29 50	46	23
32	25 13	26 18	25 42	26 48	26 10	27 19	26 39	27 49	27 7	28 20	27 36	28 50	28 5	29 21	28 33	29 51	47	24
34	25 11	26 18	25 40	26 49	26 9	27 19	26 37	27 50	27 6	28 20	27 34	28 51	28 3	29 21	28 31	29 52	48	24
36	25 10	26 19	25 38	26 49	26 7	27 20	26 35	27 50	27 4	28 21	27 33	28 51	28 1	29 22	28 30	29 52	49	25
38	25 8	26 19	25 37	26 50	26 5	27 20	26 34	27 51	27 2	28 21	27 31	28 52	27 59	29 22	28 28	29 53	50	25
40	25 7	26 20	25 35	26 50	26 4	27 21	26 32	27 51	27 0	28 22	27 29	28 52	27 57	29 23	28 26	29 53	51	26
42	25 5	26 20	25 33	26 51	26 2	27 21	26 30	27 52	26 59	28 22	27 27	28 53	27 56	29 23	28 24	29 54	52	26
44	25 3	26 21	25 32	26 51	26 0	27 22	26 29	27 52	26 57	28 23	27 25	28 53	27 54	29 24	28 22	29 54	53	27
46	25 2	26 21	25 30	26 52	25 59	27 22	26 27	27 53	26 55	28 23	27 24	28 54	27 52	29 24	28 21	29 55	54	27
48	25 0	26 22	25 29	26 52	25 57	27 23	26 25	27 54	26 54	28 24	27 22	28 54	27 50	29 25	28 19	29 56	55	28
50	24 59	26 22	25 27	26 53	25 55	27 23	26 24	27 54	26 52	28 25	27 20	28 55	27 48	29 26	28 17	29 56	56	28
52	24 57	26 23	25 25	26 54	25 54	27 24	26 22	27 55	26 50	28 25	27 18	28 56	27 47	29 26	28 15	29 57	57	29
54	24 55	26 23	25 24	26 54	25 52	27 25	26 20	27 55	26 48	28 26	27 17	28 56	27 45	29 27	28 13	29 57	58	29
56	24 54	26 24	25 22	26 55	25 50	27 25	26 18	27 56	26 47	28 26	27 15	28 57	27 43	29 27	28 11	29 58	59	30
58	24 52	26 24	25 20	26 55	25 48	27 26	26 17	27 56	26 45	28 27	27 13	28 57	27 41	29 28	28 10	29 58	60	30

(62° and 63°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	"	A
62°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"	A
0'	24 50	26 25	25 19	26 56	25 47	27 26	26 15	27 57	26 43	28 27	27 11	28 58	27 39	29 28	28 8	29 59	1	0	1
2	24 49	26 25	25 17	26 56	25 45	27 27	26 13	27 57	26 41	28 28	27 10	28 53	27 38	29 29	29 23	6 30	0	4	2
4	24 47	26 26	25 15	26 57	25 43	27 27	26 12	27 58	26 40	28 28	27 8	28 59	27 36	29 29	29 28	4 30	0	5	2
6	24 46	26 26	25 14	26 57	25 42	27 28	26 10	27 58	26 38	28 29	27 6	28 59	27 34	29 30	28 2	2 30	1	6	3
8	24 44	26 27	25 12	26 58	25 40	27 28	26 8	27 59	26 36	28 29	27 4	28 59	27 32	29 31	28 0	30	1	7	3
10	24 42	26 27	25 10	26 58	25 38	27 29	26 6	27 59	26 34	28 30	27 2	28 59	27 30	29 31	27 58	30	2	8	4
12	24 41	26 28	25 9	26 59	25 37	27 29	26 5	28 0	26 33	28 30	27 1	28 59	27 29	29 32	27 57	30	2	10	4
14	24 39	26 28	25 7	26 59	25 35	27 30	26 3	28 0	26 31	28 31	26 59	28 59	27 27	29 32	27 55	30	3	11	5
16	24 37	26 29	25 5	27 0	25 33	27 30	26 1	28 1	26 29	28 32	26 57	28 59	27 25	29 33	27 53	30	3	12	5
18	24 36	26 29	25 4	27 0	25 32	27 31	26 0	28 1	26 27	28 32	26 55	28 59	27 23	29 33	27 51	30	4	13	6
20	24 34	26 30	25 2	27 1	25 30	27 31	25 58	28 2	26 26	28 33	26 54	28 59	27 21	29 34	27 49	30	5	15	7
22	24 33	26 30	25 0	27 1	25 28	27 32	25 56	28 2	26 24	28 33	26 52	28 59	27 19	29 34	27 47	30	5	16	7
24	24 31	26 31	24 59	27 2	25 27	27 32	25 54	28 3	26 22	28 34	26 50	28 59	27 17	29 35	27 46	30	6	17	8
26	24 29	26 31	24 57	27 2	25 25	27 33	25 53	28 3	26 20	28 34	26 48	28 59	27 15	29 36	27 44	30	6	18	8
28	24 28	26 32	24 55	27 3	25 23	27 33	25 51	28 4	26 19	28 35	26 46	28 59	27 14	29 36	27 42	30	7	19	9
30	24 26	26 32	24 54	27 3	25 21	27 34	25 49	28 4	26 17	28 35	26 45	28 59	27 12	29 37	27 40	30	7	21	9
32	24 24	26 33	24 52	27 4	25 20	27 34	25 47	28 5	26 15	28 36	26 43	28 59	27 10	29 37	27 38	30	8	22	10
34	24 23	26 33	24 50	27 4	25 18	27 35	25 46	28 5	26 13	28 36	26 41	28 59	27 9	29 38	27 36	30	9	23	11
36	24 21	26 34	24 49	27 5	25 16	27 35	25 44	28 6	26 12	28 37	26 39	28 59	27 8	29 38	27 34	30	9	25	11
38	24 20	26 34	24 47	27 5	25 15	27 36	25 42	28 7	26 10	28 37	26 37	28 59	27 7	29 39	27 33	30	10	26	12
40	24 18	26 35	24 45	27 6	25 13	27 36	25 41	28 7	26 8	28 38	26 36	28 59	27 6	29 39	27 31	30	10	27	12
42	24 16	26 35	24 44	27 6	25 11	27 37	25 39	28 8	26 6	28 38	26 34	28 59	27 5	29 40	27 29	30	11	28	13
44	24 15	26 36	24 42	27 7	25 10	27 37	25 37	28 8	26 5	28 39	26 32	28 59	27 4	29 40	27 27	30	11	29	13
46	24 13	26 36	24 41	27 7	25 8	27 38	25 35	28 9	26 3	28 39	26 30	28 59	27 3	29 41	27 25	30	12	31	14
48	24 11	26 37	24 39	27 8	25 6	27 38	25 34	28 9	26 1	28 40	26 29	28 59	27 2	29 42	27 23	30	12	32	14
50	24 10	26 37	24 37	27 8	25 5	27 39	25 32	28 10	25 59	28 41	26 27	28 59	27 1	29 42	27 22	30	13	33	15
52	24 8	26 38	24 36	27 9	25 3	27 39	25 30	28 10	25 58	28 41	26 25	28 59	27 0	29 43	27 20	30	13	34	15
54	24 6	26 38	24 34	27 9	25 0	27 40	25 29	28 11	25 56	28 42	26 23	28 59	27 0	29 43	27 18	30	14	35	16
56	24 5	26 39	24 32	27 10	24 59	27 40	25 27	28 11	25 54	28 42	26 21	28 59	27 0	29 44	27 16	30	15	37	17
58	24 3	26 39	24 31	27 10	24 58	27 41	25 25	28 12	25 52	28 43	26 20	28 59	27 0	29 44	27 14	30	15	38	17
63°	54'		55'		56'		57'		58'		59'		60'		61'		16	18	20
0'	24 2	26 40	24 29	27 11	24 56	27 41	25 23	28 12	25 51	28 43	26 18	28 59	27 0	29 45	27 12	30	16	41	18
2	24 0	26 40	24 27	27 11	24 54	27 42	25 22	28 13	25 49	28 44	26 16	28 59	27 0	29 45	27 10	30	16	42	19
4	23 58	26 41	24 26	27 12	24 53	27 42	25 20	28 13	25 47	28 44	26 14	28 59	27 0	29 46	27 9	30	17	43	19
6	23 57	26 41	24 24	27 12	24 51	27 43	25 18	28 14	25 45	28 45	26 13	28 59	27 0	29 47	27 7	30	17	44	20
8	23 55	26 42	24 22	27 13	24 49	27 43	25 16	28 14	25 44	28 45	26 11	28 59	27 0	29 47	27 5	30	18	46	21
10	23 53	26 42	24 20	27 13	24 48	27 44	25 15	28 15	25 42	28 46	26 9	28 59	27 0	29 48	27 3	30	18	47	21
12	23 52	26 43	24 19	27 14	24 46	27 44	25 13	28 15	25 40	28 46	26 7	28 59	27 0	29 48	27 1	30	19	48	22
14	23 50	26 43	24 17	27 14	24 44	27 45	25 11	28 16	25 38	28 47	26 5	28 59	27 0	29 49	26 59	30	20	50	22
16	23 48	26 44	24 15	27 15	24 42	27 45	25 9	28 16	25 37	28 47	26 4	28 59	27 0	29 49	26 58	30	21	51	23
18	23 47	26 44	24 14	27 15	24 41	27 46	25 8	28 17	25 35	28 48	26 2	28 59	27 0	29 50	26 56	30	21	52	23
20	23 45	26 44	24 12	27 15	24 39	27 46	25 6	28 17	25 33	28 48	26 0	28 59	27 0	29 50	26 54	30	22	53	24
22	23 44	26 45	24 10	27 16	24 37	27 47	25 4	28 18	25 31	28 49	25 58	28 59	27 0	29 51	26 52	30	22	54	24
24	23 42	26 45	24 9	27 16	24 36	27 47	25 3	28 18	25 29	28 49	25 56	28 59	27 0	29 51	26 50	30	22	55	25
26	23 40	26 46	24 7	27 17	24 34	27 48	25 1	28 19	25 28	28 50	25 55	28 59	27 0	29 52	26 48	30	23	57	26
28	23 39	26 46	24 5	27 17	24 32	27 48	24 59	28 19	25 26	28 50	25 53	28 59	27 0	29 52	26 46	30	23	58	26
30	23 37	26 47	24 4	27 18	24 30	27 49	24 57	28 20	25 24	28 51	25 51	28 59	27 0	29 53	26 44	30	24	59	27
32	23 35	26 47	24 2	27 18	24 29	27 49	24 56	28 20	25 22	28 51	25 49	28 59	27 0	29 53	26 43	30	24	60	28
34	23 34	26 48	24 0	27 19	24 27	27 50	24 54	28 21	25 21	28 52	25 47	28 59	27 0	29 54	26 41	30	25	61	29
36	23 32	26 48	23 59	27 19	24 25	27 50	24 52	28 21	25 19	28 52	25 45	28 59	27 0	29 54	26 39	30	25	62	30
38	23 30	26 49	23 57	27 20	24 24	27 51	24 50	28 22	25 17	28 53	25 44	28 59	27 0	29 55	26 37	30	26	63	31
40	23 29	26 49	23 55	27 20	24 22	27 51	24 49	28 22	25 15	28 53	25 42	28 59	27 0	29 55	26 35	30	26	64	32
42	23 27	26 50	23 54	27 21	24 20	27 52	24 47	28 23	25 13	28 54	25 40	28 59	27 0	29 56	26 33	30	27	65	33
44	23 25	26 50	23 52	27 21	24 18	27 52	24 45	28 23	25 12	28 54	25 38	28 59	27 0	29 56	26 31	30	28	66	34
46	23 24	26 51	23 50	27 22	24 17	27 53	24 43	28 24	25 10	28 55	25 36	28 59	27 0	29 57	26 30	30	28	67	35
48	23 22	26 51	23 49	27 22	24 15	27 53	24 42	28 24	25 8	28 55	25 35	28 59	27 0	29 58	26 28	30	29	68	36
50	23 20	26 52	23 47	27 23	24 13	27 54	24 40	28 25	25 6	28 56	25 33	28 59	27 0	29 58	26 26	30	30	69	37
52	23 19	26 52	23 45	27 23	24 12	27 54	24 38	28 25	25 5	28 56	25 31	28 59	27 0	29 59	26 24	30	31	70	38
54	23 17	26 53	23 44	27 24	24 10	27 55	24 36	28 26	25 3	28 57	25 29	28 59	27 0	29 59	26 22	30	32	71	39
56	23 16	26 53	23 42	27 24	24 8	27 55	24 35	28 26	25 2	28 57	25 27	28 59	27 0	29 59	26 20	30	33	72	40
58	23 14	26 54	23 40	27 25	24 6	27 56	24 33	28 27	25 0	28 58	25 26	28 59	27 0	29 59	26 18	30	34	73	41

(w.) 'The Correction of the Moon's Altitude, and the Aux. Angle A. (64° and 65°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									Cot	A
64°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°		
0'	23 12	26 54	23 39	27 25	24 5	27 56	24 31	28 27	24 57	28 58	25 24	29 30	25 50	30 1	26 16	30 32	1	0
2	23 11	26 55	23 37	27 26	24 3	27 57	24 29	28 28	24 56	28 59	25 22	29 30	25 48	30 1	26 15	30 32	2	1
4	23 9	26 55	23 35	27 26	24 1	27 57	24 28	28 28	24 54	28 59	25 20	29 31	25 46	30 2	26 13	30 33	3	2
6	23 7	26 55	23 34	27 27	24 0	27 58	24 26	28 29	24 52	29 0	25 18	29 31	25 45	30 2	26 11	30 33	4	3
8	23 6	26 56	23 32	27 27	23 58	27 58	24 24	28 29	24 50	29 0	25 17	29 32	25 43	30 3	26 9	30 34	5	4
10	23 4	26 56	23 30	27 28	23 56	27 59	24 22	28 30	24 49	29 1	25 15	29 32	25 41	30 3	26 7	30 34	6	5
12	23 2	26 57	23 28	27 28	23 55	27 59	24 21	28 30	24 47	29 1	25 13	29 33	25 39	30 4	26 5	30 35	7	6
14	23 1	26 57	23 27	27 28	23 53	28 0	24 19	28 31	24 45	29 2	25 11	29 33	25 37	30 4	26 3	30 36	8	7
16	22 59	26 58	23 25	27 29	23 51	28 0	24 17	28 31	24 43	29 2	25 9	29 34	25 35	30 5	26 0	30 36	9	8
18	22 58	26 58	23 23	27 29	23 49	28 1	24 15	28 32	24 41	29 3	25 7	29 34	25 33	30 5	25 59	30 37	10	9
20	22 56	26 59	23 22	27 30	23 48	28 1	24 14	28 32	24 40	29 3	25 6	29 35	25 32	30 6	25 58	30 37	11	10
22	22 54	26 59	23 20	27 30	23 46	28 2	24 12	28 33	24 38	29 4	25 4	29 35	25 30	30 6	25 56	30 38	12	11
24	22 52	27 0	23 18	27 31	23 44	28 2	24 10	28 33	24 36	29 5	25 2	29 36	25 28	30 7	25 54	30 38	13	12
26	22 51	27 0	23 17	27 31	23 43	28 3	24 8	28 34	24 34	29 5	25 0	29 36	25 26	30 7	25 52	30 39	14	13
28	22 49	27 1	23 15	27 32	23 41	28 3	24 7	28 34	24 32	29 6	24 58	29 37	25 24	30 8	25 50	30 39	15	14
30	22 47	27 1	23 13	27 32	23 39	28 4	24 5	28 35	24 31	29 6	24 57	29 37	25 22	30 8	25 48	30 40	16	15
32	22 46	27 2	23 12	27 33	23 37	28 4	24 3	28 35	24 29	29 7	24 55	29 38	25 20	30 9	25 46	30 40	17	16
34	22 44	27 2	23 10	27 33	23 36	28 5	24 1	28 36	24 27	29 7	24 53	29 38	25 19	30 10	25 44	30 41	18	17
36	22 42	27 3	23 8	27 34	23 34	28 5	24 0	28 36	24 25	29 8	24 51	29 39	25 17	30 10	25 43	30 41	19	18
38	22 41	27 3	23 6	27 34	23 32	28 6	23 58	28 37	24 24	29 8	24 49	29 39	25 15	30 11	25 41	30 42	20	19
40	22 39	27 4	23 5	27 35	23 30	28 6	23 56	28 37	24 22	29 9	24 47	29 40	25 13	30 11	25 39	30 42	21	20
42	22 37	27 4	23 3	27 35	23 29	28 7	23 54	28 38	24 20	29 9	24 46	29 40	25 11	30 12	25 37	30 43	22	21
44	22 36	27 4	23 1	27 36	23 27	28 7	23 53	28 38	24 18	29 10	24 44	29 41	25 9	30 12	25 35	30 43	23	22
46	22 34	27 5	23 0	27 36	23 25	28 7	23 51	28 39	24 16	29 10	24 42	29 41	25 8	30 13	25 33	30 44	24	23
48	22 32	27 5	22 58	27 37	23 24	28 8	23 49	28 39	24 15	29 11	24 40	29 42	25 6	30 13	25 31	30 44	25	24
50	22 31	27 6	22 56	27 37	23 22	28 8	23 47	28 40	24 13	29 11	24 38	29 42	25 4	30 14	25 29	30 45	26	25
52	22 29	27 6	22 55	27 38	23 20	28 9	23 46	28 40	24 11	29 12	24 37	29 43	25 2	30 14	25 28	30 46	27	26
54	22 27	27 7	22 53	27 38	23 18	28 9	23 44	28 41	24 9	29 12	24 35	29 43	25 0	30 15	25 26	30 46	28	27
56	22 26	27 7	22 51	27 38	23 17	28 10	23 42	28 41	24 7	29 13	24 33	29 44	24 58	30 15	25 24	30 47	29	28
58	22 24	27 8	22 50	27 39	23 15	28 10	23 40	28 42	24 6	29 13	24 31	29 44	24 56	30 16	25 22	30 47	30	29
65°	54'	55'	56'	57'	58'	59'	60'	61'										
0'	22 22	27 8	22 48	27 39	23 13	28 11	23 39	28 42	24 4	29 13	24 29	29 45	24 55	30 16	25 20	30 48	1	0
2	22 21	27 8	22 46	27 40	23 11	28 11	23 37	28 43	24 2	29 14	24 27	29 45	24 53	30 17	25 18	30 48	2	1
4	22 19	27 9	22 44	27 40	23 10	28 12	23 35	28 43	24 0	29 14	24 26	29 46	24 51	30 17	25 16	30 49	3	2
6	22 17	27 9	22 43	27 41	23 8	28 12	23 33	28 44	23 58	29 15	24 24	29 46	24 49	30 18	25 14	30 49	4	3
8	22 16	27 10	22 41	27 41	23 6	28 13	23 31	28 44	23 57	29 15	24 22	29 47	24 47	30 18	25 12	30 50	5	4
10	22 14	27 10	22 39	27 42	23 4	28 13	23 30	28 44	23 55	29 16	24 20	29 47	24 45	30 19	25 10	30 50	6	5
12	22 12	27 11	22 38	27 42	23 3	28 13	23 28	28 45	23 53	29 16	24 18	29 48	24 43	30 19	25 9	30 51	7	6
14	22 11	27 11	22 36	27 43	23 1	28 14	23 26	28 45	23 51	29 17	24 16	29 48	24 42	30 20	25 7	30 51	8	7
16	22 9	27 12	22 34	27 43	22 59	28 14	23 24	28 46	23 49	29 17	24 15	29 49	24 40	30 20	25 5	30 52	9	8
18	22 7	27 12	22 32	27 43	22 58	28 15	23 23	28 46	23 48	29 18	24 13	29 49	24 38	30 21	25 3	30 52	10	9
20	22 6	27 13	22 31	27 44	22 56	28 15	23 21	28 47	23 46	29 18	24 11	29 50	24 36	30 21	25 1	30 53	11	10
22	22 4	27 13	22 29	27 44	22 54	28 16	23 19	28 47	23 44	29 19	24 9	29 50	24 34	30 22	24 59	30 53	12	11
24	22 2	27 13	22 27	27 45	22 52	28 16	23 17	28 48	23 42	29 19	24 7	29 51	24 32	30 22	24 57	30 54	13	12
26	22 1	27 14	22 26	27 45	22 51	28 17	23 16	28 48	23 41	29 20	24 5	29 51	24 30	30 23	24 55	30 54	14	13
28	21 59	27 14	22 24	27 46	22 49	28 17	23 14	28 49	23 39	29 20	24 4	29 52	24 29	30 23	24 53	30 55	15	14
30	21 57	27 15	22 22	27 46	22 47	28 18	23 12	28 49	23 37	29 21	24 2	29 52	24 27	30 24	24 52	30 55	16	15
32	21 56	27 15	22 20	27 47	22 45	28 18	23 10	28 50	23 35	29 21	24 0	29 53	24 25	30 24	24 50	30 56	17	16
34	21 54	27 16	22 19	27 47	22 44	28 19	23 8	28 50	23 33	29 22	23 58	29 53	24 23	30 25	24 48	30 56	18	17
36	21 52	27 16	22 17	27 47	22 42	28 19	23 7	28 51	23 32	29 22	23 56	29 54	24 21	30 25	24 46	30 57	19	18
38	21 51	27 16	22 15	27 48	22 40	28 20	23 5	28 51	23 30	29 23	23 54	29 54	24 19	30 26	24 44	30 58	20	19
40	21 49	27 17	22 14	27 48	22 38	28 20	23 3	28 51	23 28	29 23	23 53	29 54	24 17	30 26	24 42	30 58	21	20
42	21 47	27 17	22 12	27 49	22 37	28 20	23 1	28 52	23 26	29 23	23 51	29 55	24 16	30 27	24 40	30 58	22	21
44	21 46	27 18	22 10	27 49	22 35	28 21	23 0	28 52	23 24	29 24	23 49	29 55	24 14	30 27	24 38	30 59	23	22
46	21 44	27 18	22 9	27 50	22 33	28 21	22 58	28 53	23 23	29 24	23 47	29 56	24 12	30 28	24 36	30 59	24	23
48	21 42	27 19	22 7	27 50	22 32	28 22	22 56	28 53	23 21	29 25	23 45	29 56	24 10	30 28	24 35	31 0	25	24
50	21 41	27 19	22 5	27 51	22 30	28 22	22 54	28 54	23 19	29 25	23 43	29 57	24 8	30 28	24 33	31 0	26	25
52	21 39	27 20	22 3	27 51	22 28	28 23	22 53	28 54	23 17	29 26	23 42	29 57	24 6	30 29	24 31	31 0	27	26
54	21 37	27 20	22 2	27 52	22 26	28 23	22 51	28 55	23 15	29 26	23 40	29 58	24 4	30 29	24 29	31 0	28	27
56	21 36	27 20	22 0	27 52	22 25	28 24	22 49	28 55	23 14	29 27	23 38	29 58	24 2	30 30	24 27	31 0	29	28
58	21 34	27 21	21 58	27 52	22 23	28 24	22 47	28 56	23 12	29 27	23 36	29 59	24 0	30 30	24 25	31 0	30	29

(66° and 67°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	A
66°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	A
0'	21 32	27 21	21 57	27 53	22 21	28 24	22 45	28 56	23 10	29 28	23 34	29 59	23 59	30 31	24 23	31 3	1	0
2	21 31	27 22	21 55	27 53	22 19	28 25	22 44	28 57	23 8	29 28	23 32	30	0 23	57 30	24 21	31 3	2	1
4	21 29	27 22	21 53	27 54	22 18	28 25	22 42	28 57	23 6	29 29	23 31	30	0 23	55 30	24 19	31 4	3	2
6	21 27	27 23	21 52	27 54	22 16	28 26	22 40	28 57	23 4	29 29	23 29	30	1 23	53 30	24 17	31 4	4	2
8	21 26	27 23	21 50	27 55	22 14	28 26	22 38	28 58	23 3	29 30	23 27	30	1 23	51 30	24 16	31 5	5	2
10	21 24	27 23	21 48	27 55	22 12	28 27	22 37	28 58	23 1	29 30	23 25	30	2 23	49 30	24 14	31 5	6	2
12	21 22	27 24	21 46	27 56	22 11	28 27	22 35	28 59	22 59	29 30	23 23	30	2 23	47 30	24 12	31 5	7	2
14	21 20	27 24	21 45	27 56	22 9	28 28	22 33	28 59	22 57	29 31	23 21	30	3 23	46 30	24 10	31 6	8	2
16	21 19	27 25	21 43	27 56	22 7	28 28	22 31	29	0 22	55 29	23 19	30	3 23	44 30	24 8	31 6	9	2
18	21 17	27 25	21 41	27 57	22 5	28 28	22 29	29	0 22	54 29	23 18	30	4 23	42 30	24 6	31 7	10	2
20	21 15	27 25	21 39	27 57	22 4	28 29	22 28	29	1 22	52 29	23 16	30	4 23	40 30	24 4	31 7	11	2
22	21 14	27 26	21 38	27 58	22 2	28 29	22 26	29	1 22	50 29	23 14	30	4 23	38 30	24 2	31 8	12	2
24	21 12	27 26	21 36	27 58	22 0	28 30	22 24	29	1 22	48 29	23 12	30	5 23	36 30	24 0	31 8	13	2
26	21 10	27 27	21 34	27 59	21 58	28 30	22 22	29	2 22	46 29	23 10	30	5 23	34 30	23 58	31 9	14	2
28	21 9	27 27	21 33	27 59	21 57	28 31	22 21	29	2 22	44 29	23 8	30	6 23	32 30	23 56	31 9	15	2
30	21 7	27 28	21 31	27 59	21 55	28 31	22 19	29	3 22	43 29	23 5	30	6 23	30 30	23 54	31 10	16	2
32	21 5	27 28	21 29	28	0 21	53 28	22 17	29	3 22	41 29	23 5	30	7 23	29 30	23 53	31 10	17	2
34	21 4	27 29	21 27	28	0 21	51 28	22 15	29	4 22	39 29	23 5	30	7 23	27 30	23 51	31 11	18	2
36	21 2	27 29	21 26	28	1 21	50 28	22 13	29	4 22	37 29	23 1	30	8 23	25 30	23 49	31 11	19	2
38	21 0	27 29	21 24	28	1 21	48 28	22 12	29	5 22	35 29	23 6	30	8 23	23 30	23 47	31 12	20	2
40	20 58	27 30	21 22	28	2 21	46 28	22 10	29	5 22	34 29	23 7	30	9 23	21 30	23 45	31 12	21	2
42	20 57	27 30	21 21	28	2 21	44 28	22 8	29	6 22	32 29	23 7	30	9 23	19 30	23 43	31 13	22	2
44	20 55	27 31	21 19	28	2 21	43 28	22 6	29	6 22	30 29	23 8	30	10 23	17 30	23 41	31 13	23	2
46	20 53	27 31	21 17	28	3 21	41 28	22 4	29	6 22	28 29	23 8	30	10 23	16 30	23 39	31 14	24	2
48	20 52	27 31	21 15	28	3 21	39 28	22 3	29	7 22	26 29	23 5	30	10 23	14 30	23 37	31 14	25	2
50	20 50	27 32	21 14	28	4 21	37 28	22 1	29	7 22	25 29	23 4	30	11 23	12 30	23 35	31 14	26	2
52	20 48	27 32	21 12	28	4 21	36 28	21 59	29	8 22	23 29	23 4	30	11 23	10 30	23 33	31 15	27	2
54	20 47	27 33	21 10	28	5 21	34 28	21 57	29	8 22	21 29	23 4	30	12 23	8 30	23 32	31 15	28	2
56	20 45	27 33	21 9	28	5 21	32 28	21 56	29	9 22	19 29	23 4	30	12 23	6 30	23 30	31 16	29	2
58	20 43	27 34	21 7	28	5 21	30 28	21 54	29	9 22	17 29	23 4	30	13 23	4 30	23 28	31 16	30	2
60	20 42	27 34	21 5	28	6 21	29 28	21 52	29	9 22	15 29	23 4	30	13 23	2 30	23 26	31 17	31	2
62	20 40	27 34	21 3	28	6 21	27 28	21 50	29	10 22	14 29	23 4	30	14 23	1 30	23 24	31 17	32	2
64	20 38	27 35	21 2	28	7 21	25 28	21 49	29	10 22	12 29	23 4	30	14 23	59 30	23 22	31 18	33	2
66	20 36	27 35	21 0	28	7 21	23 28	21 47	29	11 22	10 29	23 4	30	15 23	57 30	23 20	31 18	34	2
68	20 35	27 36	20 58	28	7 21	22 28	21 45	29	11 22	8 29	23 4	30	15 23	55 30	23 18	31 19	35	2
70	20 33	27 36	20 56	28	8 21	20 28	21 43	29	12 22	6 29	23 4	30	15 23	53 30	23 16	31 19	36	2
72	20 31	27 36	20 55	28	8 21	18 28	21 42	29	12 22	4 29	23 4	30	16 23	51 30	23 14	31 20	37	2
74	20 30	27 37	20 53	28	9 21	16 28	21 40	29	13 22	3 29	23 4	30	16 23	49 30	23 12	31 20	38	2
76	20 28	27 37	20 51	28	9 21	14 28	21 38	29	13 22	1 29	23 4	30	17 23	47 30	23 10	31 21	39	2
78	20 26	27 38	20 49	28	10 21	13 28	21 37	29	13 21	59 29	23 4	30	17 23	45 30	23 8	31 21	40	2
80	20 25	27 38	20 48	28	10 21	11 28	21 35	29	14 21	57 29	23 4	30	18 23	43 30	23 6	31 21	41	2
82	20 23	27 39	20 46	28	10 21	9 28	21 33	29	14 21	55 29	23 4	30	18 23	41 30	23 5	31 22	42	2
84	20 21	27 39	20 44	28	11 21	7 28	21 31	29	15 21	53 29	23 4	30	19 23	40 30	23 3	31 22	43	2
86	20 19	27 39	20 43	28	11 21	6 28	21 30	29	15 21	52 29	23 4	30	19 23	38 30	23 1	31 23	44	2
88	20 18	27 40	20 41	28	12 21	4 28	21 27	29	16 21	50 29	23 4	30	19 23	36 30	22 59	31 23	45	2
90	20 16	27 40	20 39	28	12 21	2 28	21 24	29	16 21	48 29	23 4	30	20 23	34 30	22 57	31 24	46	2
92	20 14	27 41	20 37	28	13 21	0 28	21 22	29	16 21	46 29	23 4	30	20 23	32 30	22 55	31 24	47	2
94	20 13	27 41	20 36	28	13 20	59 28	21 22	29	17 21	44 29	23 4	30	21 23	30 30	22 53	31 25	48	2
96	20 11	27 41	20 34	28	13 20	57 28	21 20	29	17 21	42 29	23 4	30	21 23	28 30	22 51	31 25	49	2
98	20 9	27 42	20 32	28	14 20	55 28	21 18	29	18 21	41 29	23 4	30	22 23	26 30	22 49	31 26	50	2
100	20 8	27 42	20 30	28	14 20	53 28	21 16	29	18 21	39 29	23 4	30	22 23	24 30	22 47	31 26	51	2
102	20 6	27 43	20 29	28	15 20	51 28	21 14	29	19 21	37 29	23 4	30	23 23	22 30	22 45	31 27	52	2
104	20 4	27 43	20 27	28	15 20	50 28	21 12	29	19 21	35 29	23 4	30	23 23	20 30	22 43	31 27	53	2
106	20 2	27 43	20 25	28	15 20	48 28	21 11	29	20 21	33 29	23 4	30	24 23	19 30	22 41	31 28	54	2
108	20 1	27 44	20 23	28	16 20	46 28	21 9	29	20 21	31 29	23 4	30	24 23	17 30	22 39	31 28	55	2
110	19 59	27 44	20 22	28	16 20	44 28	21 7	29	20 21	30 29	23 4	30	25 23	15 30	22 37	31 29	56	2
112	19 57	27 45	20 20	28	17 20	43 28	21 5	29	21 21	28 29	23 4	30	25 23	13 30	22 35	31 29	57	2
114	19 56	27 45	20 18	28	17 20	41 28	21 3	29	21 21	26 29	23 4	30	25 23	11 30	22 33	31 30	58	2
116	19 54	27 46	20 17	28	18 20	39 28	21 2	29	22 21	24 29	23 4	30	26 23	9 30	22 31	31 30	59	2
118	19 52	27 46	20 15	28	18 20	37 28	21 0	29	22 21	22 29	23 4	30	26 23	7 30	22 29	31 30	60	2

(w.)		The Correction of the Moon's Altitude, and the Aux. Angle A. (68° and 69°)																								Seconds of H. P.	
App. Alt.	Minutes of Moon's Hor. Parallax.																								"	C	A
	54'		55'		56'		57'		58'		59'		60'		61'												
68	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°									
0'	19 51	27 46	20 13	28 18	20 36	28 50	20 58	29 23	21 20	29 55	21 43	30 27	22 53	30 59	22 28	31 31	1	0	1								
2	19 49	27 47	20 11	28 19	20 34	28 51	20 56	29 23	21 19	29 55	21 41	30 27	22 53	30 59	22 26	31 31	3	1	2								
4	19 47	27 47	20 10	28 19	20 32	28 51	20 54	29 23	21 17	29 55	21 39	30 27	22 53	30 59	22 24	31 32	5	2	3								
6	19 45	27 48	20 8	28 20	20 30	28 52	20 53	29 24	21 15	29 56	21 37	30 28	22 53	30 59	22 22	31 32	7	3	4								
8	19 44	27 48	20 6	28 20	20 28	28 52	20 51	29 24	21 13	29 56	21 35	30 28	22 56	31	0	22 20	31 33	9	4	5							
10	19 42	27 48	20 4	28 20	20 27	28 53	20 49	29 25	21 11	29 57	21 34	30 29	22 56	31	1	22 18	31 33	11	5	6							
12	19 40	27 49	20 3	28 21	20 25	28 53	20 47	29 25	21 9	29 57	21 32	30 29	22 54	31	1	22 16	31 33	13	6	7							
14	19 39	27 49	20 1	28 21	20 23	28 53	20 45	29 25	21 8	29 58	21 30	30 30	22 52	31	2	22 14	31 34	15	7	8							
16	19 37	27 50	19 59	28 22	20 21	28 54	20 44	29 26	21 6	29 58	21 28	30 30	22 50	31	2	22 12	31 34	17	8	9							
18	19 35	27 50	19 57	28 22	20 19	28 54	20 42	29 26	21 4	29 58	21 26	30 30	22 48	31	3	22 10	31 35	19	9	10							
20	19 33	27 50	19 56	28 22	20 18	28 55	20 40	29 27	21 2	29 59	21 24	30 31	22 46	31	3	22 8	31 35	21	10	11							
22	19 32	27 51	19 54	28 23	20 16	28 55	20 38	29 27	21 0	29 59	21 22	30 31	22 44	31	4	22 7	31 36	23	11	12							
24	19 30	27 51	19 52	28 23	20 14	28 55	20 36	29 28	20 58	30	0	21 20	32	4	22 5	31 36	25	12	13								
26	19 28	27 51	19 50	28 24	20 12	28 56	20 34	29 28	20 56	30	0	21 19	32	4	22 3	31 36	27	13	14								
28	19 27	27 52	19 49	28 24	20 11	28 56	20 33	29 28	20 55	30	0	21 17	33	2	22 1	31 37	29	14	15								
30	19 25	27 52	19 47	28 24	20 9	28 57	20 31	29 29	20 53	30	1	21 15	33	2	21 59	31 37	31	15	16								
32	19 23	27 53	19 45	28 25	20 7	28 57	20 29	29 29	20 51	30	1	21 13	33	2	21 57	31 38	33	16	17								
34	19 21	27 53	19 43	28 25	20 5	28 57	20 27	29 30	20 49	30	2	21 11	33	2	21 55	31 38	35	17	18								
36	19 20	27 53	19 42	28 26	20 3	28 58	20 25	29 30	20 47	30	2	21 9	34	2	21 53	31 39	37	18	19								
38	19 18	27 54	19 40	28 26	20 2	28 58	20 24	29 30	20 45	30	2	21 7	34	2	21 51	31 39	39	19	20								
40	19 16	27 54	19 38	28 26	20 0	28 59	20 22	29 31	20 44	30	3	21 5	34	2	21 49	31 39	41	20	21								
42	19 15	27 55	19 36	28 27	19 58	28 59	20 20	29 31	20 42	30	3	21 4	34	2	21 47	31 40	43	21	22								
44	19 13	27 55	19 35	28 27	19 56	28 59	20 18	29 32	20 40	30	4	21 2	34	2	21 45	31 40	45	22	23								
46	19 11	27 55	19 33	28 28	19 55	29 0	20 16	29 32	20 38	30	4	21 0	34	2	21 43	31 41	47	23	24								
48	19 9	27 56	19 31	28 28	19 53	29 0	20 15	29 32	20 36	30	5	20 58	30	37	21 20	31	49	24	25								
50	19 8	27 56	19 29	28 28	19 51	29 1	20 13	29 33	20 34	30	5	20 56	30	37	21 18	31	47	25	26								
52	19 6	27 57	19 28	28 29	19 49	29 1	20 11	29 33	20 32	30	5	20 54	30	38	21 16	31	45	26	27								
54	19 4	27 57	19 26	28 29	19 47	29 1	20 9	29 34	20 31	30	6	20 52	30	38	21 14	31	43	27	28								
56	19 3	27 57	19 24	28 30	19 46	29 2	20 7	29 34	20 29	30	6	20 50	30	39	21 12	31	41	28	29								
58	19 1	27 58	19 22	28 30	19 44	29 2	20 5	29 34	20 27	30	7	20 48	30	39	21 10	31	39	29	30								
69°	54'	55'	56'	57'	58'	59'	60'	61'																			
0'	18 59	27 58	19 21	28 30	19 42	29 3	20 4	29 35	20 25	30	7	20 47	30	39	21 8	31	12	21	30	31	44						
2	18 57	27 58	19 19	28 31	19 40	29 3	20 2	29 35	20 23	30	7	20 45	30	40	21 6	31	12	21	28	31	44						
4	18 56	27 59	19 17	28 31	19 38	29 3	20 0	29 36	20 21	30	8	20 43	30	40	21 4	31	12	21	26	31	45						
6	18 54	27 59	19 15	28 32	19 37	29 4	19 58	29 36	20 20	30	8	20 41	30	41	21 2	31	13	21	24	31	45						
8	18 52	28 0	19 14	28 32	19 35	29 4	19 56	29 36	20 18	30	9	20 39	30	41	21 0	31	13	21	22	31	46						
10	18 50	28 0	19 12	28 32	19 33	29 5	19 54	29 37	20 16	30	9	20 37	30	41	20 58	31	14	21	20	31	46						
12	18 49	28 0	19 10	28 33	19 31	29 5	19 53	29 37	20 14	30	9	20 35	30	42	20 57	31	14	21	18	31	46						
14	18 47	28 1	19 8	28 33	19 29	29 5	19 51	29 38	20 12	30	10	20 33	30	42	20 55	31	15	21	16	31	47						
16	18 45	28 1	19 7	28 33	19 28	29 6	19 49	29 38	20 10	30	10	20 31	30	43	20 53	31	15	21	14	31	47						
18	18 44	28 1	19 5	28 34	19 26	29 6	19 47	29 38	20 8	30	11	20 30	30	43	20 51	31	15	21	12	31	48						
20	18 42	28 2	19 3	28 34	19 24	29 6	19 45	29 39	20 6	30	11	20 28	30	43	20 49	31	16	21	10	31	48						
22	18 40	28 2	19 1	28 34	19 22	29 7	19 43	29 39	20 5	30	11	20 26	30	44	20 47	31	16	21	8	31	49						
24	18 38	28 3	18 59	28 35	19 21	29 7	19 42	29 40	20 3	30	12	20 24	30	44	20 45	31	17	21	6	31	49						
26	18 37	28 3	18 58	28 35	19 19	29 8	19 40	29 40	20 1	30	12	20 22	30	45	20 43	31	17	21	4	31	50						
28	18 35	28 3	18 56	28 36	19 17	29 8	19 38	29 40	19 59	30	13	20 20	30	45	20 41	31	17	21	2	31	50						
30	18 33	28 4	18 54	28 36	19 15	29 8	19 36	29 41	19 57	30	13	20 18	30	45	20 39	31	18	21	0	31	50						
32	18 31	28 4	18 52	28 36	19 13	29 9	19 34	29 41	19 55	30	13	20 16	30	46	20 37	31	18	20	58	31	51						
34	18 30	28 4	18 51	28 37	19 12	29 9	19 33	29 42	19 53	30	14	20 14	30	46	20 35	31	19	20	56	31	51						
36	18 28	28 5	18 49	28 37	19 10	29 10	19 31	29 42	19 52	30	14	20 13	30	47	20 33	31	19	20	54	31	51						
38	18 26	28 5	18 47	28 38	19 8	29 10	19 29	29 42	19 50	30	15	20 11	30	47	20 32	31	19	20	52	31	52						
40	18 24	28 5	18 45	28 38	19 6	29 10	19 27	29 43	19 48	30	15	20 9	30	47	20 30	31	20	20	50	31	52						
42	18 23	28 6	18 44	28 38	19 4	29 11	19 25	29 43	19 46	30	15	20 7	30	48	20 28	31	20	20	49	31	53						
44	18 21	28 6	18 42	28 39	19 3	29 11	19 23	29 43	19 44	30	16	20 5	30	48	20 26	31	21	20	47	31	53						
46	18 19	28 7	18 40	28 39	19 1	29 11	19 22	29 44	19 42	30	16	20 3	30	49	20 24	31	21	20	45	31	54						
48	18 18	28 7	18 38	28 39	18 59	29 12	19 20	29 44	19 40	30	17	20 1	30	49	20 22	31	22	20	43	31	54						
50	18 16	28 7	18 37	28 40	18 57	29 12	19 18	29 45	19 39	30	17	19 59	30	50	20 20	31	22	20	41	31	54						
52	18 14	28 8	18 35	28 40	18 55	29 13	19 16	29 45	19 37	30	17	19 57	30	50	20 18	31	22	20	39	31	55						
54	18 12	28 8	18 33	28 41	18 54	29 13	19 14	29 45	19 35	30	18	19 55	30	50	20 16	31	23	20	37	31	55						
56	18 11	28 9	18 31	28 41	18 52	29 13	19 12	29 46	19 33	30	18	19 54	30	51	20 14	31	23	20	35	31	55						
58	18 9	28 9	18 29	28 41	18 50	29 14	19 11	29 46	19 31	30	19	19 52	30	51	20 12	31	24	20	33	31	56						

(70° and 71°) The Correction of the Moon's Altitude, and the Aux. Angle A. (w.)

Asp. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57		58'		59'		60'		61'		"	Cor.	A
70°	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	1	0	1
	+	60"	+	60"	+	60"	+	60"	+	60"	+	60"	+	60"	+	60"			
0'	18 7 23	9	18 28 28	42	18 48 29	14	19 9 29	47	19 29 30	19	19 50 30	52	20 10 31	24	20 31 31	56	3	1	2
2	18 5 28	10	18 26 28	42	18 46 29	15	19 7 29	47	19 27 30	19	19 48 30	52	20 8 31	24	20 29 31	57	4	1	2
4	18 4 28	10	18 24 28	43	18 45 29	15	19 5 29	47	19 26 30	20	19 46 30	52	20 7 31	25	20 27 31	57	5	2	3
6	18 2 28	10	18 22 28	43	18 43 29	15	19 3 28	48	19 24 30	20	19 44 30	53	20 5 31	25	20 25 31	58	6	2	3
8	18 0 28	11	18 21 28	43	18 41 29	16	19 1 28	48	19 22 30	21	19 42 30	53	20 3 31	26	20 23 31	58	7	2	4
10	17 58 28	11	18 19 28	44	18 39 29	16	19 0 29	49	19 20 30	21	19 40 30	54	20 1 31	26	20 21 31	59	8	3	4
12	17 57 28	11	18 17 28	44	18 37 29	16	18 58 29	49	19 18 30	21	19 38 30	54	19 59 31	26	20 19 31	59	9	3	5
14	17 55 28	12	18 15 28	44	18 36 29	17	18 56 29	49	19 16 30	22	19 36 30	54	19 57 31	27	20 17 31	59	10	3	5
16	17 53 28	12	18 14 28	45	18 34 29	17	18 54 29	50	19 14 30	22	19 35 30	55	19 55 31	27	20 15 32	0	12	4	7
18	17 52 28	13	18 12 28	45	18 32 29	18	18 52 29	50	19 12 30	23	19 33 30	55	19 53 31	28	20 13 32	0	13	4	7
20	17 50 28	13	18 10 28	45	18 30 29	18	18 50 29	50	19 10 30	23	19 31 30	55	19 51 31	28	20 11 32	1	14	5	8
22	17 48 28	13	18 8 28	46	18 28 29	18	18 49 29	51	19 9 30	23	19 29 30	56	19 49 31	29	20 9 32	1	15	5	8
24	17 46 28	14	18 6 28	46	18 27 29	19	18 47 29	51	19 7 30	24	19 27 30	56	19 47 31	29	20 7 32	1	16	5	9
26	17 45 28	14	18 5 28	47	18 25 29	19	18 45 29	52	19 5 30	24	19 25 30	57	19 45 31	29	20 5 32	2	17	6	9
28	17 43 28	14	18 3 28	47	18 23 29	19	18 43 29	52	19 3 30	25	19 23 30	57	19 43 31	30	20 3 32	2	18	6	10
30	17 41 28	15	18 1 28	47	18 21 29	20	18 41 29	52	19 1 30	25	19 21 30	58	19 41 31	30	20 1 32	3	19	6	10
32	17 39 28	15	17 59 28	48	18 19 29	20	18 39 29	53	18 59 30	25	19 19 30	58	19 39 31	31	19 59 32	3	20	6	11
34	17 38 28	15	17 58 28	48	18 18 29	21	18 38 29	53	18 58 30	26	19 18 30	58	19 37 31	31	19 58 32	4	21	6	11
36	17 36 28	16	17 56 28	48	18 16 29	21	18 36 29	54	18 56 30	26	19 16 30	59	19 36 31	31	19 56 32	4	22	6	11
38	17 34 28	16	17 54 28	49	18 14 29	21	18 34 29	54	18 54 30	27	19 14 30	59	19 34 31	32	19 54 32	4	23	6	11
40	17 32 28	17	17 52 28	49	18 12 29	22	18 32 29	54	18 52 30	27	19 12 31	0	19 32 31	32	19 52 32	5	24	6	11
42	17 31 28	17	17 51 28	50	18 10 29	22	18 30 29	55	18 50 30	27	19 10 31	0	19 30 31	33	19 50 32	5	25	6	11
44	17 29 28	17	17 49 28	50	18 9 29	23	18 28 29	55	18 48 30	28	19 8 31	0	19 28 31	33	19 48 32	6	26	6	11
46	17 27 28	18	17 47 28	50	18 7 29	23	18 27 29	56	18 46 30	28	19 6 31	1	19 26 31	33	19 46 32	6	27	6	11
48	17 26 28	18	17 45 28	51	18 5 29	23	18 25 29	56	18 45 30	29	19 4 31	1	19 24 31	34	19 44 32	6	28	6	11
50	17 24 28	18	17 44 28	51	18 3 29	24	18 23 29	56	18 43 30	29	19 2 31	2	19 22 31	34	19 42 32	7	29	6	11
52	17 22 28	19	17 42 28	51	18 1 29	24	18 21 29	57	18 41 30	29	19 0 31	2	19 20 31	35	19 40 32	7	30	6	11
54	17 20 28	19	17 40 28	52	18 0 29	24	18 19 29	57	18 39 30	30	18 59 31	3	19 18 31	35	19 38 32	8	31	6	11
56	17 19 28	19	17 38 28	52	17 58 29	25	18 17 29	57	18 37 30	30	18 57 31	3	19 16 31	35	19 36 32	8	32	6	11
58	17 17 28	20	17 36 28	53	17 56 29	25	18 16 29	58	18 35 30	31	18 55 31	3	19 14 31	36	19 34 32	8	33	6	11
71°	54'		55'		56'		57'		58'		59'		60'		61'		39	13	21
0'	17 15 28	20	17 35 28	53	17 54 29	25	18 14 29	58	18 33 30	31	18 53 31	4	19 12 31	36	19 32 32	9	40	13	22
2	17 13 28	21	17 33 28	53	17 52 29	25	18 12 29	59	18 32 30	31	18 51 31	4	19 11 31	37	19 30 32	9	41	13	22
4	17 12 28	21	17 31 28	54	17 51 29	26	18 10 29	59	18 30 30	32	18 49 31	4	19 9 31	37	19 28 32	10	42	13	23
6	17 10 28	21	17 29 28	54	17 49 29	27	18 8 29	59	18 28 30	32	18 47 31	5	19 7 31	37	19 26 32	10	43	13	23
8	17 8 28	22	17 28 28	54	17 47 29	27	18 6 30	0	18 26 30	32	18 45 31	5	19 5 31	38	19 24 32	10	44	13	23
10	17 6 28	22	17 26 28	55	17 45 29	27	18 5 30	0	18 24 30	33	18 43 31	5	19 3 31	38	19 22 32	11	45	13	24
12	17 5 28	22	17 24 28	55	17 43 29	28	18 3 30	0	18 22 30	33	18 41 31	6	19 1 31	38	19 20 32	11	46	13	24
14	17 3 28	23	17 22 28	55	17 42 29	28	18 1 30	1	18 20 30	33	18 39 31	6	18 59 31	39	19 18 32	12	47	13	24
16	17 1 28	23	17 20 28	56	17 40 29	28	17 59 30	1	18 18 30	34	18 38 31	6	18 57 31	39	19 16 32	12	48	13	24
18	16 59 28	23	17 19 28	56	17 38 29	29	17 57 30	1	18 16 30	34	18 36 31	7	18 55 31	39	19 14 32	12	49	13	24
20	16 58 28	24	17 17 28	56	17 36 29	29	17 55 30	2	18 14 30	34	18 34 31	7	18 53 31	40	19 12 32	13	50	13	24
22	16 56 28	24	17 15 28	57	17 34 29	29	17 53 30	2	18 13 30	35	18 32 31	7	18 51 31	40	19 10 32	13	51	13	24
24	16 54 28	24	17 13 28	57	17 32 29	30	17 52 30	2	18 11 30	35	18 30 31	8	18 49 31	41	19 8 32	13	52	13	24
26	16 52 28	25	17 12 28	57	17 31 29	30	17 50 30	3	18 9 30	36	18 28 31	8	18 47 31	41	19 6 32	14	53	13	24
28	16 51 28	25	17 10 28	58	17 29 29	30	17 48 30	3	18 7 30	36	18 26 31	9	18 45 31	41	19 4 32	14	54	13	24
30	16 49 28	25	17 8 28	58	17 27 29	31	17 46 30	4	18 5 30	36	18 24 31	9	18 43 31	42	19 2 32	15	55	13	24
32	16 47 28	26	17 6 28	58	17 25 29	31	17 44 30	4	18 3 30	37	18 22 31	9	18 41 31	42	19 0 32	15	56	13	24
34	16 45 28	26	17 4 28	59	17 23 29	32	17 42 30	4	18 1 30	37	18 20 31	10	18 39 31	43	18 58 32	15	57	13	24
36	16 44 28	26	17 3 28	59	17 22 29	32	17 40 30	5	17 59 30	37	18 18 31	10	18 37 31	43	18 56 32	16	58	13	24
38	16 42 28	27	17 1 28	59	17 20 29	32	17 39 30	5	17 58 30	38	18 17 31	11	18 35 31	43	18 54 32	16	59	13	24
40	16 40 28	27	16 59 29	0	17 18 29	33	17 37 30	5	17 56 30	38	18 15 31	11	18 33 31	44	18 52 32	16	60	13	24
42	16 38 28	27	16 57 29	0	17 16 29	33	17 35 30	6	17 54 30	38	18 13 31	11	18 31 31	44	18 50 32	17	61	13	24
44	16 37 28	28	16 55 29	0	17 14 29	33	17 33 30	6	17 52 30	39	18 11 31	12	18 29 31	44	18 48 32	17	62	13	24
46	16 35 28	28	16 54 29	1	17 12 29	34	17 31 30	7	17 50 30	39	18 9 31	12	18 27 31	45	18 46 32	18	63	13	24
48	16 33 28	28	16 52 29	1	17 11 29	34	17 29 30	7	17 48 30	40	18 7 31	12	18 26 31	45	18 44 32	18	64	13	24
50	16 31 28	29	16 50 29	1	17 9 29	34	17 28 30	7	17 46 30	40	18 5 31	13	18 24 31	46	18 42 32	18	65	13	24
52	16 30 28	29	16 48 29	2	17 7 29	35	17 26 30	8	17 44 30	40	18 3 31	13	18 22 31	46	18 40 32	19	66	13	24
54	16 28 28	29	16 47 29	2	17 5 29	35	17 24 30	8	17 43 30	41	18 1 31	13	18 20 31	46	18 38 32	19	67	13	24
56	16 26 28	30	16 45 29	3	17 3 29	35	17 22 30	8	17 41 30	41	17 59 31	14	18 18 31	47	18 36 32	20	68	13	24
58	16 24 28	30	16 43 29	3	17 2 29	36	17 20 30	9	17 39 30	41	17 57 31	14	18 16 31	47	18 34 32	20	69	13	24

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (72° and 73°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.				
	54'		55'		56'		57'		58'		59'		60'		61'		"	"	"		
	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	°	'	"		
72°																	1	0	1		
0'	16 23	28 30	15 41	29 3	17 0	29 36	17 18	30 9	17 37	30 42	17 55	31 15	18 14	31 47	18 32	32 20	2	1	1		
2	16 21	28 31	16 39	29 4	16 58	29 36	17 16	30 9	17 35	30 42	17 53	31 15	18 12	31 48	18 30	32 21	3	1	2		
4	16 19	28 31	16 38	29 4	16 56	29 37	17 15	30 10	17 33	30 42	17 52	31 15	18 10	31 48	18 28	32 21	4	1	3		
6	16 17	28 31	16 36	29 4	16 54	29 37	17 13	30 10	17 31	30 43	17 50	31 16	18 8	31 49	18 26	32 21	5	1	3		
8	16 16	28 32	16 34	29 5	16 52	29 37	17 11	30 10	17 29	30 43	17 48	31 16	18 6	31 49	18 24	32 22	6	2	3		
10	16 14	28 32	16 32	29 5	16 51	29 38	17 9	30 11	17 27	30 43	17 46	31 16	18 4	31 49	18 22	32 22	7	2	4		
12	16 12	28 32	16 30	29 9	16 49	29 38	17 7	30 11	17 25	30 44	17 44	31 17	18 2	31 50	18 20	32 22	8	2	4		
14	16 10	28 33	16 29	29 6	16 47	29 38	17 5	30 11	17 24	30 44	17 42	31 17	18 0	31 50	18 18	32 23	9	3	5		
16	16 9	28 33	16 27	29 6	16 45	29 39	17 3	30 12	17 22	30 45	17 40	31 17	17 58	31 50	18 16	32 23	10	3	6		
18	16 7	28 33	16 25	29 6	16 43	29 39	17 2	30 12	17 20	30 45	17 38	31 18	17 56	31 51	18 14	32 24	11	3	6		
20	16 5	28 34	16 23	29 6	16 41	29 39	17 0	30 12	17 18	30 45	17 36	31 18	17 54	31 51	18 12	32 24	12	3	7		
22	16 3	28 34	16 21	29 7	16 40	29 40	16 58	30 13	17 16	30 46	17 34	31 18	17 52	31 51	18 11	32 24	13	4	7		
24	16 2	28 34	16 20	29 7	16 38	29 40	16 56	30 13	17 14	30 46	17 32	31 19	17 50	31 52	18 9	32 25	14	4	8		
26	16 0	28 35	16 18	29 7	16 36	29 41	16 54	30 13	17 12	30 46	17 30	31 19	17 48	31 52	18 7	32 25	15	4	8		
28	15 58	28 35	16 16	29 8	16 34	29 41	16 52	30 14	17 10	30 47	17 28	31 19	17 46	31 52	18 5	32 25	16	5	9		
30	15 56	28 35	16 14	29 8	16 32	29 41	16 50	30 14	17 8	30 47	17 26	31 20	17 44	31 53	18 3	32 26	17	5	9		
32	15 54	28 35	16 12	29 8	16 31	29 42	16 49	30 14	17 6	30 47	17 25	31 20	17 43	31 53	18 1	32 26	18	5	10		
34	15 53	28 36	16 11	29 9	16 29	29 42	16 47	30 15	17 5	30 48	17 23	31 21	17 41	31 53	17 59	32 26	19	6	10		
36	15 51	28 36	16 9	29 9	16 27	29 42	16 45	30 15	17 3	30 48	17 21	31 21	17 39	31 54	17 57	32 27	20	6	11		
38	15 49	28 36	16 7	29 9	16 25	29 43	16 43	30 15	17 1	30 49	17 19	31 21	17 37	31 54	17 55	32 27	21	7	11		
40	15 47	28 37	16 5	29 10	16 23	29 43	16 41	30 16	16 59	30 49	17 17	31 22	17 35	31 54	17 53	32 27	22	7	12		
42	15 46	28 37	16 4	29 10	16 21	29 43	16 39	30 16	16 57	30 49	17 14	31 22	17 33	31 55	17 51	32 28	23	8	12		
44	15 44	28 37	16 2	29 10	16 20	29 43	16 37	30 16	16 55	30 49	17 12	31 22	17 31	31 55	17 49	32 28	24	8	13		
46	15 42	28 38	16 0	29 11	16 18	29 44	16 36	30 17	16 53	30 50	17 10	31 23	17 29	31 56	17 47	32 29	25	9	13		
48	15 40	28 38	15 58	29 11	16 16	29 44	16 34	30 17	16 51	30 50	17 9	31 23	17 27	31 56	17 45	32 29	26	9	14		
50	15 39	28 38	15 56	29 11	16 14	29 44	16 32	30 17	16 49	30 50	17 7	31 23	17 25	31 56	17 43	32 29	27	10	14		
52	15 37	28 39	15 55	29 12	16 12	29 45	16 30	30 18	16 48	30 51	17 5	31 24	17 23	31 57	17 41	32 30	28	10	15		
54	15 35	28 39	15 53	29 12	16 10	29 45	16 28	30 18	16 46	30 51	17 3	31 24	17 21	31 57	17 39	32 30	29	11	15		
56	15 33	28 39	15 51	29 12	16 9	29 45	16 26	30 18	16 44	30 51	17 1	31 24	17 19	31 57	17 37	32 30	30	11	16		
58	15 32	28 40	15 49	29 13	16 7	29 46	16 24	30 19	16 42	30 52	16 59	31 25	17 17	31 58	17 35	32 31	31	12	16		
73°	54'	55'	56'	57'	58'	59'	60'	61'	54'	55'	56'	57'	58'	59'	60'	61'	40	12	22		
0'	15 30	28 40	15 47	29 13	16 5	29 46	16 22	30 19	16 40	30 52	16 57	31 25	17 15	31 58	17 33	32 31	41	12	23		
2	15 28	28 40	15 46	29 13	16 3	29 46	16 21	30 19	16 38	30 52	16 56	31 25	17 13	31 59	17 31	32 32	42	12	23		
4	15 26	28 40	15 44	29 14	16 1	29 47	16 19	30 20	16 36	30 53	16 54	31 26	17 11	31 59	17 29	32 32	43	13	24		
6	15 24	28 41	15 42	29 14	15 59	29 47	16 17	30 20	16 34	30 53	16 52	31 26	17 9	31 59	17 27	32 32	44	13	24		
8	15 23	28 41	15 40	29 14	15 58	29 47	16 15	30 20	16 32	30 53	16 50	31 26	17 7	32	0	17 25	32 33	45	13	25	
10	15 21	28 41	15 38	29 14	15 56	29 48	16 13	30 21	16 30	30 54	16 48	31 27	17 5	32	0	17 23	32 33	46	14	26	
12	15 19	28 42	15 37	29 15	15 54	29 48	16 11	30 21	16 29	30 54	16 46	31 27	17 3	32	0	17 21	32 33	47	14	26	
14	15 17	28 42	15 35	29 15	15 52	29 48	16 9	30 21	16 27	30 54	16 44	31 27	17 1	32	1	17 19	32 34	48	14	27	
16	15 16	28 42	15 33	29 15	15 50	29 48	16 7	30 22	16 25	30 55	16 42	31 28	16 59	32	1	17 17	32 34	49	15	28	
18	15 14	28 43	15 31	29 16	15 48	29 49	16 6	30 22	16 23	30 55	16 40	31 28	16 57	32	1	17 15	32 34	50	15	29	
20	15 12	28 43	15 29	29 16	15 46	29 49	16 4	30 22	16 21	30 55	16 38	31 28	16 55	32	1	17 13	32 35	51	16	30	
22	15 10	28 43	15 27	29 16	15 45	29 49	16 2	30 23	16 19	30 56	16 36	31 29	16 53	32	2	17 11	32 35	52	16	30	
24	15 9	28 44	15 26	29 17	15 43	29 50	16 0	30 23	16 17	30 56	16 34	31 29	16 51	32	2	17 9	32 35	53	16	31	
26	15 7	28 44	15 24	29 17	15 41	29 50	15 58	30 23	16 15	30 56	16 32	31 29	16 49	32	3	17 7	32 36	54	17	31	
28	15 5	28 44	15 22	29 17	15 39	29 50	15 56	30 24	16 13	30 57	16 30	31 30	16 47	32	3	17 5	32 36	55	17	32	
30	15 3	28 44	15 20	29 18	15 37	29 51	15 54	30 24	16 11	30 57	16 28	31 30	16 45	32	3	17 3	32 36	56	18	33	
32	15 1	28 45	15 18	29 18	15 36	29 51	15 53	30 24	16 9	30 57	16 27	31 30	16 44	32	4	17 1	32 37	57	18	33	
34	15 0	28 45	15 17	29 18	15 34	29 51	15 51	30 25	16 8	30 58	16 25	31 31	16 42	32	4	16 59	32 37	58	19	34	
36	14 58	28 45	15 15	29 19	15 32	29 52	15 48	30 25	16 6	30 58	16 23	31 31	16 40	32	4	16 57	32 37	59	19	34	
38	14 56	28 46	15 13	29 19	15 30	29 52	15 47	30 25	16 4	30 58	16 21	31 31	16 38	32	5	16 55	32 38	60	20	35	
40	14 54	28 46	15 11	29 19	15 28	29 52	15 45	30 25	16 2	30 59	16 19	31 32	16 36	32	5	16 53	32 38	61	20	35	
42	14 53	28 46	15 9	29 19	15 26	29 53	15 43	30 26	16 0	30 59	16 17	31 32	16 34	32	5	16 51	32 39	62	21	36	
44	14 51	28 47	15 8	29 20	15 25	29 53	15 41	30 26	15 58	30 59	16 15	31 32	16 32	32	6	16 49	32 39	63	21	36	
46	14 49	28 47	15 6	29 20	15 23	29 53	15 39	30 26	15 56	31	0	16 13	31 33	16 30	32	6	16 47	32 39	64	22	37
48	14 47	28 47	15 4	29 20	15 21	29 54	15 38	30 27	15 54	31	0	16 11	31 33	16 28	32	6	16 45	32 39	65	22	

(74° and 75°) The Correction of the Moon's Altitude, and the Aux. Angle. (w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	"	
74°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	—	0	
0'	14 37	28 49	14 53	29 22	15 10	29 55	15 26	30 29	15 43	31 2	15 59	31 35	16 16	32 8	16 32	32 41	1	1	
2	14 35	28 49	14 51	29 22	15 8	29 56	15 24	30 29	15 41	31 2	15 57	31 35	16 14	32 9	16 30	32 42	1	2	
4	14 33	28 50	14 50	29 23	15 6	29 56	15 23	30 29	15 39	31 3	15 55	31 36	16 12	32 9	16 28	32 42	1	3	
6	14 31	28 50	14 48	29 23	15 4	29 56	15 21	30 30	15 37	31 3	15 54	31 36	16 10	32 9	16 26	32 42	2	3	
8	14 30	28 50	14 46	29 23	15 2	29 57	15 19	30 30	15 35	31 3	15 52	31 36	16 8	32 9	16 24	32 43	2	4	
10	14 28	28 50	14 44	29 24	15 1	29 57	15 17	30 30	15 33	31 3	15 50	31 37	16 6	32 10	16 22	32 43	2	5	
12	14 26	28 51	14 42	29 24	14 59	29 57	15 15	30 30	15 31	31 4	15 48	31 37	16 4	32 10	16 20	32 43	3	5	
14	14 24	28 51	14 41	29 24	14 57	29 57	15 13	30 31	15 29	31 4	15 46	31 37	16 2	32 10	16 18	32 44	3	6	
16	14 22	28 51	14 39	29 25	14 55	29 58	15 11	30 31	15 28	31 4	15 44	31 38	16 0	32 11	16 16	32 44	3	7	
18	14 21	28 52	14 37	29 25	14 53	29 58	15 9	30 31	15 26	31 5	15 42	31 38	15 58	32 11	16 14	32 44	4	8	
20	14 19	28 52	14 35	29 25	14 51	29 58	15 7	30 32	15 24	31 5	15 40	31 38	15 56	32 11	16 12	32 45	4	8	
22	14 17	28 52	14 33	29 25	14 49	29 59	15 6	30 32	15 22	31 5	15 38	31 39	15 54	32 12	16 10	32 45	4	9	
24	14 15	28 52	14 31	29 26	14 48	29 59	15 4	30 32	15 20	31 6	15 36	31 39	15 52	32 12	16 8	32 45	5	10	
26	14 14	28 53	14 30	29 26	14 46	29 59	15 2	30 33	15 18	31 6	15 34	31 39	15 50	32 12	16 6	32 46	5	11	
28	14 12	28 53	14 28	29 26	14 44	30 0	15 0	30 33	15 16	31 6	15 32	31 39	15 48	32 13	16 4	32 46	5	11	
30	14 10	28 53	14 26	29 27	14 42	30 0	14 58	30 33	15 14	31 6	15 30	31 40	15 46	32 13	16 2	32 46	6	12	
32	14 8	28 54	14 24	29 27	14 40	30 0	14 56	30 33	15 12	31 7	15 28	31 40	15 44	32 13	16 0	32 47	6	12	
34	14 6	28 54	14 22	29 27	14 38	30 0	14 54	30 34	15 10	31 7	15 26	31 40	15 42	32 14	15 58	32 47	6	13	
36	14 5	28 54	14 21	29 28	14 36	30 1	14 52	30 34	15 8	31 7	15 24	31 41	15 40	32 14	15 56	32 47	6	14	
38	14 3	28 55	14 19	29 28	14 35	30 1	14 51	30 34	15 7	31 8	15 22	31 41	15 38	32 14	15 54	32 48	7	15	
40	14 1	28 55	14 17	29 28	14 33	30 1	14 49	30 35	15 5	31 8	15 20	31 41	15 36	32 15	15 52	32 48	7	15	
42	13 59	28 55	14 15	29 28	14 31	30 2	14 47	30 35	15 3	31 8	15 19	31 42	15 34	32 15	15 50	32 48	8	16	
44	13 58	28 55	14 13	29 29	14 29	30 2	14 45	30 36	15 0	31 9	15 17	31 42	15 32	32 15	15 48	32 49	8	17	
46	13 56	28 56	14 12	29 29	14 27	30 2	14 43	30 36	14 59	31 9	15 15	31 42	15 30	32 16	15 46	32 49	8	17	
48	13 54	28 56	14 10	29 29	14 25	30 3	14 41	30 36	14 57	31 9	15 13	31 43	15 28	32 16	15 44	32 49	9	18	
50	13 52	28 56	14 8	29 30	14 24	30 3	14 39	30 36	14 55	31 10	15 11	31 43	15 26	32 16	15 42	32 49	9	18	
52	13 50	28 57	14 6	29 30	14 22	30 3	14 37	30 36	14 53	31 10	15 9	31 43	15 24	32 17	15 40	32 50	9	19	
54	13 49	28 57	14 4	29 30	14 20	30 3	14 36	30 37	14 51	31 10	15 7	31 43	15 22	32 17	15 38	32 50	9	20	
56	13 47	28 57	14 2	29 30	14 18	30 4	14 34	30 37	14 49	31 10	15 5	31 44	15 20	32 17	15 36	32 50	10	21	
58	13 45	28 57	14 1	29 31	14 16	30 4	14 32	30 37	14 47	31 11	15 2	31 44	15 18	32 17	15 34	32 51	10	21	
75°	54'	55'	56'	57'	58'	59'	60'	61'	39	10	22	41	11	23	42	11	23	39	10
0'	13 43	28 58	13 59	29 31	14 14	30 4	14 30	30 38	14 45	31 11	15 1	31 44	15 16	32 18	15 32	32 51	41	11	23
2	13 41	28 58	13 57	29 31	14 13	30 5	14 28	30 38	14 43	31 11	14 59	31 45	15 14	32 18	15 30	32 51	42	11	23
4	13 39	28 58	13 55	29 32	14 11	30 5	14 26	30 38	14 42	31 12	14 57	31 45	15 12	32 18	15 28	32 52	43	11	24
6	13 38	28 59	13 53	29 32	14 9	30 5	14 24	30 39	14 40	31 12	14 55	31 45	15 10	32 19	15 26	32 52	44	11	25
8	13 36	28 59	13 52	29 32	14 7	30 6	14 22	30 39	14 38	31 12	14 53	31 46	15 8	32 19	15 24	32 52	45	12	25
10	13 34	28 59	13 50	29 32	14 5	30 6	14 20	30 39	14 36	31 12	14 51	31 46	15 6	32 19	15 22	32 53	47	12	26
12	13 33	28 59	13 48	29 33	14 3	30 6	14 19	30 39	14 34	31 13	14 49	31 46	15 4	32 20	15 20	32 53	49	13	27
14	13 31	29 0	13 46	29 33	14 1	30 6	14 17	30 40	14 32	31 13	14 47	31 46	15 2	32 20	15 18	32 53	50	13	28
16	13 29	29 0	13 44	29 33	14 0	30 7	14 15	30 40	14 30	31 13	14 45	31 47	15 0	32 20	15 16	32 53	51	13	28
18	13 27	29 0	13 42	29 34	13 58	30 7	14 13	30 40	14 28	31 14	14 43	31 47	14 58	32 20	15 14	32 54	52	13	29
20	13 25	29 0	13 41	29 34	13 56	30 7	14 11	30 41	14 26	31 14	14 41	31 47	14 56	32 21	15 12	32 54	53	14	30
22	13 24	29 1	13 39	29 34	13 54	30 7	14 9	30 41	14 24	31 14	14 39	31 48	14 55	32 21	15 10	32 54	54	14	30
24	13 22	29 1	13 37	29 34	13 52	30 8	14 7	30 41	14 22	31 14	14 38	31 48	14 53	32 21	15 8	32 55	56	14	31
26	13 20	29 1	13 35	29 35	13 50	30 8	14 5	30 41	14 21	31 15	14 36	31 48	14 51	32 22	15 6	32 55	57	15	32
28	13 18	29 1	13 33	29 35	13 48	30 8	14 3	30 42	14 19	31 15	14 34	31 48	14 49	32 22	15 4	32 55	58	15	32
30	13 16	29 2	13 31	29 35	13 46	30 9	14 2	30 42	14 17	31 15	14 32	31 49	14 47	32 22	15 2	32 56	59	15	33
32	13 15	29 2	13 30	29 35	13 45	30 9	14 0	30 42	14 15	31 16	14 30	31 49	14 45	32 22	15 0	32 56	60	15	33
34	13 13	29 2	13 28	29 36	13 43	30 9	13 58	30 43	14 13	31 16	14 28	31 49	14 43	32 23	14 58	32 56	61	15	33
36	13 11	29 2	13 26	29 36	13 41	30 9	13 56	30 43	14 12	31 16	14 26	31 50	14 41	32 23	14 56	32 57	62	16	34
38	13 9	29 3	13 24	29 36	13 39	30 10	13 54	30 43	14 10	31 17	14 25	31 50	14 39	32 23	14 54	32 57	63	16	34
40	13 7	29 3	13 22	29 36	13 37	30 10	13 52	30 43	14 8	31 17	14 23	31 50	14 38	32 24	14 51	32 57	64	16	35
42	13 6	29 3	13 21	29 37	13 35	30 10	13 50	30 44	14 6	31 17	14 21	31 51	14 36	32 24	14 49	32 57	65	17	35
44	13 4	29 4	13 19	29 37	13 33	30 10	13 48	30 44	14 4	31 17	14 19	31 51	14 33	32 24	14 47	32 58	66	17	35
46	13 2	29 4	13 17	29 37	13 32	30 11	13 46	30 44	14 2	31 18	14 17	31 51	14 31	32 25	14 45	32 58	67	18	36
48	13 0	29 4	13 15	29 38	13 30	30 11	13 45	30 45	14 0	31 18	14 15	31 51	14 29	32 25	14 43	32 58	68	18	36
50	12 59	29 4	13 13	29 38	13 28	30 11	13 43	30 45	13 58	31 18	14 12	31 52	14 27	32 25	14 41	32 59	69	19	37
52	12 57	29 5	13 11	29 38	13 26	30 12	13 41	30 45	13 56	31 19	14 10	31 52	14 25	32 25	14 39	32 59	70	19	37
54	12 55	29 5	13 10	29 38	13 24	30 12	13 39	30 45	13 54	31 19	14 8								

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (76° and 77°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									Cor.	A
76°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°		
0'	12 50 29	6 13 4	29 39	13 19 30	13 13 33	30 46	13 48 31	20 14 2	31 53 14	17 32 27	14 31 33	0	1	0	1			
2	12 48 29	6 13 2	29 39	13 17 30	13 13 31	30 46	13 46 31	20 14 0	31 53 14	15 32 27	14 29 33	0	4	1	2			
4	12 46 29	6 13 0	29 40	13 15 30	13 13 29	30 47	13 44 31	20 13 58	31 54 14	14 13 32	14 27 33	1	5	1	3			
6	12 44 29	6 12 59	29 40	13 13 30	13 13 27	30 47	13 42 31	21 13 56	31 54 14	11 32 28	14 25 33	1	6	1	3			
8	12 42 29	7 12 57	29 40	13 11 30	14 13 26	30 47	13 40 31	21 13 54	31 54 14	9 32 28	14 23 33	1	7	2	4			
10	12 41 29	7 12 55	29 40	13 9 30	14 13 24	30 47	13 38 31	21 13 52	31 55 14	7 32 28	14 21 33	2	8	2	5			
12	12 39 29	7 12 53	29 41	13 7 30	14 13 22	30 48	13 36 31	21 13 50	31 55 14	5 32 28	14 19 33	2	10	2	6			
14	12 37 29	7 12 51	29 41	13 6 30	15 13 20	30 48	13 34 31	22 13 48	31 55 14	3 32 29	14 17 33	2	11	2	6			
16	12 35 29	8 12 49	29 41	13 4 30	15 13 18	30 48	13 32 31	22 13 46	31 55 14	1 32 29	14 15 33	2	12	3	7			
18	12 33 29	8 12 48	29 41	13 2 30	15 13 16	30 49	13 30 31	22 13 44	31 56 15	32 29	14 13 33	3	13	3	8			
20	12 32 29	8 12 46	29 42	13 0 30	15 13 14	30 49	13 28 31	22 13 42	31 56 15	32 29	14 11 33	3	15	3	8			
22	12 30 29	8 12 44	29 42	12 58 30	16 13 12	30 49	13 26 31	23 13 41	31 56 15	32 30	14 9 33	3	16	4	9			
24	12 28 29	9 12 42	29 42	12 56 30	16 13 10	30 49	13 24 31	23 13 39	31 56 15	32 30	14 7 33	4	17	4	9			
26	12 26 29	9 12 40	29 42	12 54 30	16 13 8	30 50	13 23 31	23 13 37	31 57 15	32 31	14 5 33	4	18	4	10			
28	12 24 29	9 12 38	29 43	12 53 30	16 13 7	30 50	13 21 31	23 13 35	31 57 15	32 31	14 3 33	4	19	4	11			
30	12 23 29	9 12 37	29 43	12 51 30	17 13 5	30 50	13 19 31	24 13 33	31 57 15	32 31	14 1 33	4	21	5	12			
32	12 21 29	10 12 35	29 43	12 49 30	17 13 3	30 50	13 17 31	24 13 31	31 57 15	32 31	13 59 33	5	22	5	12			
34	12 19 29	10 12 33	29 43	12 47 30	17 13 1	30 51	13 15 31	24 13 29	31 58 15	32 31	13 57 33	5	23	5	13			
36	12 17 29	10 12 31	29 44	12 45 30	17 12 59	30 51	13 13 31	24 13 27	31 58 15	32 31	13 55 33	5	24	5	13			
38	12 15 29	10 12 29	29 44	12 43 30	18 12 57	30 51	13 11 31	25 13 25	31 58 15	32 31	13 53 33	5	26	6	15			
40	12 14 29	11 12 27	29 44	12 41 30	18 12 55	30 51	13 9 31	25 13 23	31 58 15	32 31	13 50 33	6	27	6	15			
42	12 12 29	11 12 26	29 44	12 40 30	18 12 53	30 52	13 7 31	25 13 21	31 59 15	32 31	13 48 33	6	28	6	16			
44	12 10 29	11 12 24	29 45	12 38 30	18 12 51	30 52	13 5 31	25 13 19	31 59 15	32 31	13 46 33	6	30	7	17			
46	12 8 29	11 12 22	29 45	12 36 30	19 12 49	30 52	13 3 31	26 13 17	31 59 15	32 31	13 44 33	7	31	7	17			
48	12 6 29	12 12 20	29 45	12 34 30	19 12 48	30 52	13 1 31	26 13 15	32 0	13 29	13 42 33	7	32	7	18			
50	12 5 29	12 12 18	29 45	12 32 30	19 12 46	30 53	12 59 31	26 13 13	32 0	13 27	13 40 33	7	33	7	18			
52	12 3 29	12 12 17	29 46	12 30 30	19 12 44	30 53	12 57 31	27 13 11	32 0	13 25	13 38 33	7	34	8	19			
54	12 1 29	12 12 15	29 46	12 28 30	20 12 42	30 53	12 55 31	27 13 9	32 0	13 23	13 36 33	8	35	8	20			
56	11 59 29	13 12 13	29 46	12 26 30	20 12 40	30 53	12 53 31	27 13 7	32 1	13 21	13 34 33	8	36	8	21			
58	11 57 29	13 12 11	29 46	12 25 30	20 12 38	30 54	12 52 31	27 13 5	32 1	13 19	13 32 33	8	38	9	21			
77°	54'	55'	56'	57'	58'	59'	60'	61'										
0'	11 56 29	13 12 9	29 47	12 23 30	20 12 36	30 54	12 50 31	28 13 3	32 1	13 17	32 35	13 30 33	8	41	9	23		
2	11 54 29	13 12 7	29 47	12 21 30	21 12 34	30 54	12 48 31	28 13 1	32 1	13 15	32 35	13 28 33	9	42	9	23		
4	11 52 29	14 12 5	29 47	12 19 30	21 12 32	30 54	12 46 31	28 12 59	32 2	13 13	32 35	13 26 33	9	43	10	24		
6	11 50 29	14 12 4	29 47	12 17 30	21 12 30	30 55	12 44 31	28 12 57	32 2	13 11	32 36	13 24 33	9	44	10	25		
8	11 48 29	14 12 2	29 48	12 15 30	21 12 29	30 55	12 42 31	29 12 55	32 2	13 9	32 36	13 22 33	10	46	10	26		
10	11 47 29	14 12 0	29 48	12 13 30	22 12 27	30 55	12 40 31	29 12 53	32 2	13 7	32 36	13 20 33	10	47	11	26		
12	11 45 29	14 11 58	29 48	12 11 30	22 12 25	30 55	12 38 31	29 12 51	32 3	13 5	32 36	13 18 33	10	48	11	27		
14	11 43 29	15 11 56	29 48	12 10 30	22 12 23	30 56	12 36 31	29 12 49	32 3	13 3	32 37	13 16 33	10	50	11	28		
16	11 41 29	15 11 54	29 49	12 8 30	22 12 21	30 56	12 34 31	30 12 47	32 3	13 1	32 37	13 14 33	11	51	11	28		
18	11 39 29	15 11 52	29 49	12 6 30	23 12 19	30 56	12 32 31	30 12 45	32 4	12 59	32 37	13 12 33	11	52	12	29		
20	11 38 29	15 11 51	29 49	12 4 30	23 12 17	30 56	12 30 31	30 12 43	32 4	12 56	32 37	13 10 33	11	53	12	30		
22	11 36 29	16 11 49	29 49	12 2 30	23 12 15	30 57	12 28 31	30 12 41	32 4	12 54	32 38	13 8 33	11	54	12	31		
24	11 34 29	16 11 47	29 50	12 0 30	23 12 13	30 57	12 26 31	31 12 39	32 4	12 52	32 38	13 6 33	12	56	13	31		
26	11 32 29	16 11 45	29 50	11 58 30	24 12 11	30 57	12 24 31	31 12 37	32 5	12 50	32 38	13 4 33	12	57	13	32		
28	11 30 29	16 11 43	29 50	11 56 30	24 12 9	30 57	12 22 31	31 12 35	32 5	12 48	32 39	13 2 33	12	58	13	32		
30	11 29 29	17 11 42	29 50	11 55 30	24 12 8	30 58	12 20 31	31 12 33	32 5	12 46	32 39	12 59 33	12	59	13	33		
32	11 27 29	17 11 40	29 50	11 53 30	24 12 6	30 58	12 19 31	32 12 32	32 5	12 44	32 39	12 57 33	13	60	13	33		
34	11 25 29	17 11 38	29 51	11 51 30	24 12 4	30 58	12 17 31	32 12 30	32 6	12 42	32 39	12 55 33	13	61	13	33		
36	11 23 29	17 11 36	29 51	11 49 30	25 12 2	30 58	12 15 31	32 12 28	32 6	12 40	32 40	12 53 33	13	62	13	33		
38	11 21 29	17 11 34	29 51	11 47 30	25 12 0	30 59	12 13 31	32 12 26	32 6	12 38	32 40	12 51 33	14	63	14	34		
40	11 20 29	18 11 32	29 51	11 45 30	25 11 58	30 59	12 11 31	33 12 24	32 6	12 36	32 40	12 49 33	14	64	14	34		
42	11 18 29	18 11 31	29 52	11 43 30	25 11 56	30 59	12 9 31	33 12 22	32 7	12 34	32 40	12 47 33	14	65	14	34		
44	11 16 29	18 11 29	29 52	11 41 30	26 11 54	30 59	12 7 31	33 12 20	32 7	12 32	32 41	12 45 33	14	66	14	34		
46	11 14 29	18 11 27	29 52	11 40 30	26 11 52	31 0	12 5 31	33 12 18	32 7	12 30	32 41	12 43 33	15	67	15	35		
48	11 12 29	19 11 25	29 52	11 38 30	26 11 50	31 0	12 3 31	34 12 16	32 7	12 28	32 41	12 41 33	15	68	15	35		
50	11 11 29	19 11 23	29 53	11 36 30	26 11 48	31 0	12 1 31	34 12 14	32 8	12 26	32 41	12 39 33	15	69	15	35		
52	11 9 29	19 11 21	29 53	11 34 30	27 11 47	31 0	11 59 31	34 12 12	32 8	12 24	32 42	12 37 33	16	70	16	36		
54	11 7 29	19 11 20	29 53	11 32 30	27 11 45	31 1	11 57 31	34 12 10	32 8	12 22	32 42	12 35 33	16	71	16	36		
56	11 5 29	20 11 18	29 53	11 30 30	27 11 43	31 1	11 55 31	35 12 8	32 8	12 20	32 42	12 33 33	16	72	16	36		
58	11 3 29	20 11 16	29 54	11 28 30	27 11 41	31 1	11 53 31	35 12 6	32 9	12 18	32 42	12 31 33	16	73	16	36		

(78° and 79°) The Correction of the Moon's Altitude, and the Aux. Angle A (w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	"
78°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	11 1 29 20	11 14 29 54	11 26 30 28	11 39 31	1 11 51 31 35	12 4 32	9 12 16 32 43	12 29 33 16	3 1 2	1 0	1						1	0
2	11 0 29 20	11 12 29 54	11 25 30 28	11 37 31	2 11 49 31 35	12 2 32	9 12 14 32 43	12 27 33 17	4 1 2	1 1	2						4	1
4	10 58 29 20	11 10 29 54	11 23 30 28	11 35 31	2 11 48 31 36	12 0 32	9 12 12 32 43	12 25 33 17	5 1 3	1 3	3						5	1
6	10 56 29 21	11 8 29 54	11 21 30 28	11 33 31	2 11 46 31 36	11 58 32	10 12 10 32 43	12 23 33 17	6 1 3	1 3	3						6	1
8	10 54 29 21	11 7 29 55	11 19 30 28	11 31 31	2 11 44 31 36	11 56 32	10 12 8 32 44	12 21 33 17	7 1 4	1 4	4						7	1
10	10 52 29 21	11 5 29 55	11 17 30 29	11 29 31	2 11 42 31 36	11 54 32	10 12 6 32 44	12 19 33 18	8 2 4	2 4	4						8	2
12	10 51 29 21	11 3 29 55	11 15 30 29	11 27 31	3 11 40 31 36	11 52 32	10 12 4 32 44	12 17 33 18	9 2 5	2 5	5						9	2
14	10 49 29 22	11 1 29 55	11 13 30 29	11 26 31	3 11 38 31 37	11 50 32	11 12 2 32 44	12 15 33 18	10 2 6	2 6	6						10	2
16	10 47 29 22	10 59 29 56	11 11 30 29	11 24 31	3 11 36 31 37	11 48 32	11 12 0 32 45	12 13 33 18	11 2 7	2 7	7						11	2
18	10 45 29 22	10 57 29 56	11 10 30 30	11 22 31	3 11 34 31 37	11 46 32	11 11 58 32 45	12 10 33 19	12 2 7	2 7	7						12	2
20	10 43 29 22	10 55 29 56	11 8 30 30	11 20 31	4 11 32 31 37	11 44 32	11 11 56 32 45	12 8 33 19	13 2 8	2 8	8						13	2
22	10 42 29 22	10 54 29 56	11 6 30 30	11 18 31	4 11 30 31 38	11 42 32	11 11 54 32 45	12 6 33 19	14 2 8	2 8	8						14	2
24	10 40 29 23	10 52 29 56	11 4 30 30	11 16 31	4 11 28 31 38	11 40 32	11 11 52 32 45	12 4 33 19	15 3 9	3 9	9						15	3
26	10 38 29 23	10 50 29 57	11 2 30 30	11 14 31	4 11 26 31 38	11 38 32	11 11 50 32 46	12 2 33 20	16 3 9	3 9	9						16	3
28	10 36 29 23	10 48 29 57	11 0 30 31	11 12 31	5 11 24 31 38	11 36 32	11 11 48 32 46	12 0 33 20	17 3 9	3 9	9						17	3
30	10 34 29 23	10 46 29 57	10 58 30 31	11 10 31	5 11 22 31 39	11 34 32	11 11 46 32 46	11 58 33 20	18 3 10	3 10	10						18	3
32	10 33 29 24	10 44 29 57	10 56 30 31	11 8 31	5 11 20 31 39	11 32 32	11 11 44 32 46	11 56 33 20	19 3 10	3 10	10						19	3
34	10 31 29 24	10 43 29 58	10 55 30 31	11 6 31	5 11 18 31 39	11 30 32	11 11 42 32 47	11 54 33 21	20 4 11	4 11	11						20	4
36	10 29 29 24	10 41 29 58	10 53 30 32	11 5 31	5 11 16 31 39	11 28 32	11 11 40 32 47	11 52 33 21	21 4 12	4 12	12						21	4
38	10 27 29 24	10 39 29 58	10 51 30 32	11 3 31	6 11 14 31 40	11 26 32	11 11 38 32 47	11 50 33 21	22 4 12	4 12	12						22	4
40	10 25 29 24	10 37 29 58	10 49 30 32	11 1 31	6 11 12 31 40	11 24 32	11 11 36 32 47	11 48 33 21	23 4 13	4 13	13						23	4
42	10 23 29 25	10 35 29 58	10 47 30 32	10 59 31	6 11 11 31 40	11 22 32	11 11 34 32 48	11 46 33 22	24 5 13	5 13	13						24	5
44	10 22 29 25	10 33 29 59	10 45 30 33	10 57 31	6 11 9 31 40	11 20 32	11 11 32 32 48	11 44 33 22	25 5 14	5 14	14						25	5
46	10 20 29 25	10 32 29 59	10 43 30 33	10 55 31	7 11 7 31 40	11 18 32	11 11 30 32 48	11 42 33 22	26 5 15	5 15	15						26	5
48	10 18 29 25	10 30 29 59	10 41 30 33	10 53 31	7 11 5 31 41	11 16 32	11 11 28 32 48	11 40 33 22	27 5 15	5 15	15						27	5
50	10 16 29 25	10 28 29 59	10 39 30 33	10 51 31	7 11 3 31 41	11 14 32	11 11 26 32 49	11 38 33 23	28 5 16	5 16	16						28	5
52	10 14 29 26	10 26 30	10 38 30 33	10 49 31	7 11 1 31 41	11 12 32	11 11 24 32 49	11 36 33 23	29 6 16	6 16	16						29	6
54	10 13 29 26	10 24 30	10 36 30 34	10 47 31	8 10 59 31 41	11 10 32	11 11 22 32 50	11 34 33 23	30 6 17	6 17	17						30	6
56	10 11 29 26	10 22 30	10 34 30 34	10 45 31	8 10 57 31 42	11 8 32	11 11 20 32 50	11 31 33 23	31 6 17	6 17	17						31	6
58	10 9 29 26	10 21 30	10 32 30 34	10 44 31	8 10 55 31 42	11 6 32	11 11 18 32 50	11 29 33 24	32 6 18	6 18	18						32	6
79°	54'	55'	56'	57'	58'	59'	60'	61'	39	40	41	42	43	44	45	46	7	22
0'	10 7 29 27	10 19 30	10 30 30 34	10 42 31	8 10 53 31 42	11 4 32	11 11 16 32 50	11 27 33 24	40 8 22	8 22	22						40	8
2	10 5 29 27	10 17 30	10 28 30 35	10 40 31	8 10 51 31 42	11 2 32	11 11 14 32 50	11 25 33 24	41 8 23	8 23	23						41	8
4	10 4 29 27	10 15 30	10 26 30 35	10 38 31	9 10 49 31 42	11 0 32	11 11 12 32 50	11 23 33 24	42 8 24	8 24	24						42	8
6	10 2 29 27	10 13 30	10 24 30 35	10 36 31	9 10 47 31 43	10 58 32	11 11 10 32 50	11 21 33 24	43 8 25	8 25	25						43	8
8	10 0 29 27	10 11 30	10 23 30 35	10 34 31	9 10 45 31 43	10 56 32	11 11 8 32 51	11 19 33 25	44 8 25	8 25	25						44	8
10	9 58 29 28	10 9 30	10 21 30 35	10 32 31	9 10 43 31 43	10 54 32	11 11 6 32 51	11 17 33 25	45 9 25	9 25	25						45	9
12	9 56 29 28	10 8 30	10 19 30 36	10 30 31	9 10 41 31 43	10 52 32	11 11 4 32 51	11 15 33 25	46 9 26	9 26	26						46	9
14	9 54 29 28	10 6 30	10 17 30 36	10 28 31	10 10 39 31 43	10 50 32	11 11 2 32 51	11 13 33 25	47 9 27	9 27	27						47	9
16	9 53 29 28	10 4 30	10 15 30 36	10 26 31	10 10 37 31 44	10 48 32	11 11 0 32 51	11 11 33 25	48 9 27	9 27	27						48	9
18	9 51 29 28	10 2 30	10 13 30 36	10 24 31	10 10 35 31 44	10 46 32	11 10 58 32 52	11 9 33 26	49 9 27	9 27	27						49	9
20	9 49 29 28	10 0 30	10 11 30 36	10 22 31	10 10 33 31 44	10 44 32	11 10 56 32 52	11 7 33 26	50 10 28	10 28	28						50	10
22	9 47 29 29	9 58 30	10 9 30 36	10 20 31	10 10 31 31 44	10 43 32	11 10 54 32 52	11 5 33 26	51 10 28	10 28	28						51	10
24	9 45 29 29	9 56 30	10 7 30 37	10 18 31	10 10 29 31 45	10 41 32	11 10 52 32 52	11 3 33 26	52 10 29	10 29	29						52	10
26	9 44 29 29	9 55 30	10 6 30 37	10 17 31	10 10 28 31 45	10 39 32	11 10 50 32 53	11 1 33 27	53 10 30	10 30	30						53	10
28	9 42 29 29	9 53 30	10 4 30 37	10 15 31	10 10 26 31 45	10 37 32	11 10 47 32 53	10 58 33 27	54 10 31	10 31	31						54	10
30	9 40 29 29	9 51 30	10 2 30 37	10 13 31	10 10 24 31 45	10 35 32	11 10 45 32 53	10 56 33 27	55 11 31	11 31	31						55	11
32	9 38 29 30	9 49 30	10 0 30 37	10 11 31	10 10 22 31 45	10 33 32	11 10 43 32 53	10 54 33 27	56 11 32	11 32	32						56	11
34	9 36 29 30	9 47 30	4 58 30 38	10 9 31	10 10 20 31 46	10 31 32	11 10 41 32 53	10 52 33 27	57 11 32	11 32	32						57	11
36	9 34 29 30	9 45 30	4 56 30 38	10 7 31	10 10 18 31 46	10 29 32	11 10 39 32 54	10 50 33 28	58 11 33	11 33	33						58	11
38	9 33 29 30	9 43 30	4 54 30 38	10 5 31	10 10 16 31 46	10 27 32	11 10 37 32 54	10 48 33 28	59 11 33	11 33	33						59	11
40	9 31 29 30	9 42 30	4 52 30 38	10 3 31	10 10 14 31 46	10 25 32	11 10 36 32 54	10 46 33 28	60 11 33	11 33	33						60	11
42	9 29 29 31	9 40 30	5 50 30 38	10 1 31	10 10 12 31 46	10 23 32	11 10 34 32 54	10 44 33 28	61 11 33	11 33	33						61	11
44	9 27 29 31	9 38 30	5 49 30 39	9 59 31	10 10 10 31 47	10 21 32	11 10 32 32 55	10 42 33 29	62 11 33	11 33	33						62	11
46	9 25 29 31	9 36 30	5 47 30 39	9 57 31	10 10 8 31 47	10 19 32	11 10 30 32 55	10 40 33 29	63 11 33	11 33	33						63	11
48	9 24 29 31	9 34 30	5 45 30 39	9 55 31	10 10 6 31 47	10 17 32	11 10 27 32 55	10 3										

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (80° and 81°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	Cor.	A
80°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"	"
0'	9 13	29 32	9 23	30 6	9 33	30 40	9 44	31 14	9 54	31 48	10 5	32 22	10 15	32 56	10 25	33 30	1	0	1
2	9 11	29 33	9 21	30 7	9 31	30 40	9 42	31 14	9 52	31 48	10 3	32 22	10 13	32 56	10 24	33 30	3	0	2
4	9 9	29 33	9 19	30 7	9 30	30 41	9 40	31 15	9 50	31 49	10 1	32 23	10 11	32 57	10 21	33 31	5	1	3
6	9 7	29 33	9 17	30 7	9 28	30 41	9 38	31 15	9 48	31 49	9 59	32 23	10 9	32 57	10 19	33 31	7	1	3
8	9 5	29 33	9 16	30 7	9 26	30 41	9 36	31 15	9 46	31 49	9 57	32 23	10 7	32 57	10 17	33 31	9	1	5
10	9 3	29 33	9 14	30 7	9 24	30 41	9 34	31 15	9 44	31 49	9 54	32 23	10 5	32 57	10 15	33 31	11	1	5
12	9 2	29 33	9 12	30 7	9 22	30 41	9 32	31 15	9 42	31 49	9 52	32 23	10 3	32 57	10 13	33 31	13	2	6
14	9 0	29 34	9 10	30 8	9 20	30 42	9 30	31 16	9 40	31 50	9 50	32 24	10 1	32 58	10 11	33 32	15	2	6
16	8 58	29 34	9 8	30 8	9 18	30 42	9 28	31 16	9 38	31 50	9 48	32 24	9 59	32 58	10 9	33 32	17	2	7
18	8 56	29 34	9 6	30 8	9 16	30 42	9 26	31 16	9 36	31 50	9 46	32 24	9 57	32 58	10 7	33 32	19	2	8
20	8 54	29 34	9 4	30 8	9 14	30 42	9 24	31 16	9 34	31 50	9 44	32 24	9 55	32 58	10 5	33 32	21	3	9
22	8 52	29 34	9 2	30 8	9 13	30 42	9 22	31 16	9 32	31 50	9 42	32 24	9 53	32 58	10 3	33 32	23	3	9
24	8 51	29 34	9 1	30 8	9 11	30 42	9 21	31 16	9 31	31 50	9 40	32 24	9 51	32 58	10 1	33 32	25	3	10
26	8 49	29 35	8 59	30 9	9 9	30 43	9 19	31 17	9 29	31 51	9 38	32 25	9 49	32 59	9 59	33 33	27	3	10
28	8 47	29 35	8 57	30 9	9 7	30 43	9 17	31 17	9 27	31 51	9 37	32 25	9 47	32 59	9 57	33 33	29	3	11
30	8 45	29 35	8 55	30 9	9 5	30 43	9 15	31 17	9 25	31 51	9 35	32 25	9 45	32 59	9 54	33 33	31	3	12
32	8 43	29 35	8 53	30 9	9 3	30 43	9 13	31 17	9 23	31 51	9 33	32 25	9 43	32 59	9 52	33 33	33	3	13
34	8 42	29 35	8 51	30 9	9 1	30 43	9 11	31 17	9 21	31 51	9 31	32 25	9 41	32 59	9 50	33 33	35	4	13
36	8 40	29 35	8 49	30 9	8 59	30 44	9 9	31 18	9 19	31 52	9 29	32 26	9 39	33 0	9 48	33 34	37	4	14
38	8 38	29 36	8 48	30 10	8 57	30 44	9 7	31 18	9 17	31 52	9 27	32 26	9 37	33 0	9 46	33 34	39	4	15
40	8 36	29 36	8 46	30 10	8 56	30 44	9 5	31 18	9 15	31 52	9 25	32 26	9 34	33 0	9 44	33 34	41	4	16
42	8 34	29 36	8 44	30 10	8 54	30 44	9 3	31 18	9 13	31 52	9 23	32 26	9 32	33 0	9 42	33 34	43	4	16
44	8 32	29 36	8 42	30 10	8 52	30 44	9 1	31 18	9 11	31 52	9 21	32 26	9 30	33 0	9 40	33 34	45	5	17
46	8 31	29 36	8 40	30 10	8 50	30 44	9 0	31 18	9 9	31 52	9 19	32 26	9 28	33 1	9 38	33 35	47	5	18
48	8 29	29 36	8 38	30 11	8 48	30 45	8 58	31 19	9 7	31 53	9 17	32 27	9 26	33 1	9 36	33 35	49	5	19
50	8 27	29 37	8 36	30 11	8 46	30 45	8 56	31 19	9 5	31 53	9 15	32 27	9 24	33 1	9 34	33 35	51	5	20
52	8 25	29 37	8 35	30 11	8 44	30 45	8 54	31 19	9 3	31 53	9 13	32 27	9 22	33 1	9 32	33 35	53	6	20
54	8 23	29 37	8 33	30 11	8 42	30 45	8 52	31 19	9 1	31 53	9 11	32 27	9 20	33 1	9 30	33 35	55	6	21
56	8 21	29 37	8 31	30 11	8 40	30 45	8 50	31 19	8 59	31 53	9 9	32 27	9 18	33 1	9 28	33 36	57	6	21
58	8 20	29 37	8 29	30 11	8 38	30 45	8 48	31 20	8 57	31 54	9 7	32 28	9 16	33 2	9 26	33 36	59	6	22
81°	54'	55'	56'	57'	58'	59'	60'	61'	54'	55'	56'	57'	58'	59'	60'	61'	Alt.	A	"
0'	8 18	29 37	8 27	30 12	8 37	30 46	8 46	31 20	8 55	31 54	9 5	32 28	9 14	33 2	9 24	33 36	40	6	23
2	8 16	29 38	8 25	30 12	8 35	30 46	8 44	31 20	8 53	31 54	9 3	32 28	9 12	33 2	9 22	33 36	42	7	24
4	8 14	29 38	8 23	30 12	8 33	30 46	8 42	31 20	8 51	31 54	9 1	32 28	9 10	33 2	9 19	33 36	44	7	25
6	8 12	29 38	8 22	30 12	8 31	30 46	8 40	31 20	8 49	31 54	8 59	32 28	9 8	33 2	9 17	33 36	46	7	26
8	8 10	29 38	8 20	30 12	8 29	30 46	8 38	31 20	8 47	31 54	8 57	32 28	9 6	33 3	9 15	33 37	48	7	26
10	8 9	29 38	8 18	30 12	8 27	30 46	8 36	31 20	8 45	31 55	8 55	32 29	9 4	33 3	9 13	33 37	50	8	27
12	8 7	29 38	8 16	30 12	8 25	30 47	8 34	31 21	8 44	31 55	8 53	32 29	9 2	33 3	9 11	33 37	52	8	28
14	8 5	29 39	8 14	30 13	8 23	30 47	8 32	31 21	8 42	31 55	8 51	32 29	9 0	33 3	9 9	33 37	54	8	29
16	8 3	29 39	8 12	30 13	8 21	30 47	8 30	31 21	8 40	31 55	8 49	32 29	8 58	33 3	9 7	33 37	56	8	29
18	8 1	29 39	8 10	30 13	8 19	30 47	8 29	31 21	8 38	31 55	8 47	32 29	8 56	33 3	9 5	33 38	58	8	30
20	7 59	29 39	8 8	30 13	8 17	30 47	8 27	31 21	8 36	31 55	8 45	32 29	8 54	33 3	9 3	33 38	60	9	31
22	7 58	29 39	8 7	30 13	8 16	30 47	8 25	31 21	8 34	31 56	8 43	32 30	8 52	33 4	9 1	33 38	62	9	32
24	7 56	29 39	8 5	30 13	8 14	30 48	8 23	31 22	8 32	31 56	8 41	32 30	8 50	33 4	8 59	33 38	64	9	32
26	7 54	29 39	8 3	30 14	8 12	30 48	8 21	31 22	8 30	31 56	8 39	32 30	8 48	33 4	8 57	33 38	66	9	33
28	7 52	29 40	8 1	30 14	8 10	30 48	8 19	31 22	8 28	31 56	8 37	32 30	8 46	33 4	8 55	33 38	68	9	33
30	7 50	29 40	7 59	30 14	8 8	30 48	8 17	31 22	8 26	31 56	8 35	32 30	8 43	33 4	8 52	33 39	70	9	34
32	7 48	29 40	7 57	30 14	8 6	30 48	8 15	31 22	8 24	31 56	8 33	32 30	8 41	33 5	8 50	33 39	72	9	34
34	7 47	29 40	7 55	30 14	8 4	30 48	8 13	31 22	8 22	31 57	8 31	32 31	8 39	33 5	8 48	33 39	74	9	34
36	7 45	29 40	7 54	30 14	8 2	30 48	8 11	31 23	8 20	31 57	8 29	32 31	8 37	33 5	8 46	33 39	76	9	34
38	7 43	29 40	7 52	30 14	8 0	30 49	8 9	31 23	8 18	31 57	8 27	32 31	8 35	33 5	8 44	33 39	78	9	34
40	7 41	29 40	7 50	30 15	7 58	30 49	8 7	31 23	8 16	31 57	8 25	32 31	8 33	33 5	8 42	33 39	80	9	34
42	7 39	29 41	7 48	30 15	7 57	30 49	8 5	31 23	8 14	31 57	8 23	32 31	8 31	33 5	8 40	33 40	82	9	34
44	7 37	29 41	7 46	30 15	7 55	30 49	8 3	31 23	8 12	31 57	8 21	32 31	8 29	33 6	8 38	33 40	84	9	34
46	7 36	29 41	7 44	30 15	7 53	30 49	8 1	31 23	8 10	31 58	8 19	32 32	8 27	33 6	8 36	33 40	86	9	34
48	7 34	29 41	7 42	30 15	7 51	30 49	7 59	31 24	8 8	31 58	8 17	32 32	8 25	33 6	8 34	33 40	88	9	34
50	7 32	29 41	7 40	30 15	7 49	30 50	7 58	31 24	8 6	31 58	8 15	32 32	8 23	33 6	8 32	33 40	90	9	34
52	7 30	29 41	7 39	30 16	7 47	30 50	7 56	31 24	8 4	31 58	8 13	32 32	8 21	33 6	8 30	33 40	92	9	34
54	7 28	29 42	7 37	30 16	7 45	30 50	7 54	31 24	8 2	31 58	8 11	32 32	8 19	33 6	8 28	33 41	94	9	34
56	7 26	29 42	7 35	30 16	7 43	30 50	7 52	31 24	8 0	31 58	8 9	32 33	8 17	33 7	8 25	33 41	96	9	34
58	7 25	29 42	7 33	30 16	7 41	30 50	7 50	31 24	7 58	31 59	8 7	32 33	8 15	33 7	8 23	33 41	98	9	34

(82° and 83°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54		55'		56'		57'		58'		59'		60'		61'		"	"
82°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	7 23 29 42	7 31 30 16	7 39 30 50	7 48 31 25	7 56 31 59	8 5 32 33	8 13 33 7	8 21 33 41	8 29 33 55	8 37 34 9	8 45 34 23	8 53 34 37	8 61 34 51	8 69 35 5	8 77 35 19	8 85 35 33	1	0
2	7 21 29 42	7 29 30 16	7 38 30 51	7 46 31 25	7 54 31 59	8 3 32 33	8 11 33 7	8 19 33 41	8 27 33 55	8 35 34 9	8 43 34 23	8 51 34 37	8 59 34 51	8 67 35 5	8 75 35 19	8 83 35 33	2	0
4	7 19 29 42	7 27 30 17	7 36 30 51	7 44 31 25	7 52 31 59	8 1 32 33	8 9 33 7	8 17 33 42	8 25 33 56	8 33 34 10	8 41 34 24	8 49 34 38	8 57 34 52	8 65 35 6	8 73 35 20	8 81 35 34	3	0
6	7 17 29 43	7 26 30 17	7 34 30 51	7 42 31 25	7 50 31 59	7 59 32 33	8 7 33 7	8 15 33 42	8 23 33 56	8 31 34 10	8 39 34 24	8 47 34 38	8 55 34 52	8 63 35 6	8 71 35 20	8 79 35 34	4	0
8	7 15 29 43	7 24 30 17	7 32 30 51	7 40 31 25	7 48 31 59	7 57 32 33	8 5 33 8	8 13 33 42	8 21 33 56	8 29 34 10	8 37 34 24	8 45 34 38	8 53 34 52	8 61 35 6	8 69 35 20	8 77 35 34	5	0
10	7 14 29 43	7 22 30 17	7 30 30 51	7 38 31 25	7 46 31 59	7 55 32 34	8 3 33 8	8 11 33 42	8 19 33 56	8 27 34 10	8 35 34 24	8 43 34 38	8 51 34 52	8 59 35 6	8 67 35 20	8 75 35 34	6	0
12	7 12 29 43	7 20 30 17	7 28 30 51	7 36 31 25	7 44 32 0	7 53 32 34	8 1 33 8	8 9 33 42	8 17 33 56	8 25 34 10	8 33 34 24	8 41 34 38	8 49 34 52	8 57 35 6	8 65 35 20	8 73 35 34	7	0
14	7 10 29 43	7 18 30 17	7 26 30 51	7 34 31 26	7 42 32 0	7 50 32 34	7 59 33 8	8 7 33 42	8 15 33 56	8 23 34 10	8 31 34 24	8 39 34 38	8 47 34 52	8 55 35 6	8 63 35 20	8 71 35 34	8	0
16	7 8 29 43	7 16 30 17	7 24 30 52	7 32 31 26	7 40 32 0	7 49 32 34	7 57 33 8	8 5 33 42	8 13 33 56	8 21 34 10	8 29 34 24	8 37 34 38	8 45 34 52	8 53 35 6	8 61 35 20	8 69 35 34	9	0
18	7 6 29 43	7 14 30 18	7 22 30 52	7 30 31 26	7 38 32 0	7 47 32 34	7 55 33 8	8 3 33 43	8 11 33 57	8 19 34 11	8 27 34 25	8 35 34 39	8 43 34 53	8 51 35 7	8 59 35 21	8 67 35 35	10	0
20	7 4 29 43	7 12 30 18	7 20 30 52	7 28 31 26	7 36 32 0	7 44 32 34	7 52 33 9	8 0 33 43	8 8 33 57	8 16 34 11	8 24 34 25	8 32 34 39	8 40 34 53	8 48 35 7	8 56 35 21	8 64 35 35	11	0
22	7 3 29 44	7 11 30 18	7 18 30 52	7 26 31 26	7 35 32 0	7 42 32 35	7 50 33 9	7 58 33 43	8 6 33 57	8 14 34 11	8 22 34 25	8 30 34 39	8 38 34 53	8 46 35 7	8 54 35 21	8 62 35 35	12	0
24	7 1 29 44	7 9 30 18	7 17 30 52	7 25 31 26	7 33 32 0	7 40 32 35	7 48 33 9	7 56 33 43	8 4 33 57	8 12 34 11	8 20 34 25	8 28 34 39	8 36 34 53	8 44 35 7	8 52 35 21	8 60 35 35	13	0
26	6 59 29 44	7 7 30 18	7 15 30 52	7 23 31 27	7 31 32 1	7 38 32 35	7 46 33 9	7 54 33 43	8 2 33 57	8 10 34 11	8 18 34 25	8 26 34 39	8 34 34 53	8 42 35 7	8 50 35 21	8 58 35 35	14	0
28	6 57 29 44	7 5 30 18	7 13 30 53	7 21 31 27	7 29 32 1	7 36 32 35	7 44 33 9	7 52 33 43	8 0 33 57	8 8 34 11	8 16 34 25	8 24 34 39	8 32 34 53	8 40 35 7	8 48 35 21	8 56 35 35	15	0
30	6 55 29 44	7 3 30 18	7 11 30 53	7 19 31 27	7 27 32 1	7 34 32 35	7 42 33 9	7 50 33 44	7 58 33 58	8 6 34 12	8 14 34 26	8 22 34 40	8 30 34 54	8 38 35 8	8 46 35 22	8 54 35 36	16	0
32	6 53 29 44	7 1 30 18	7 9 30 53	7 17 31 27	7 25 32 1	7 32 32 35	7 40 33 10	7 48 33 44	7 56 33 58	8 4 34 12	8 12 34 26	8 20 34 40	8 28 34 54	8 36 35 8	8 44 35 22	8 52 35 36	17	0
34	6 52 29 44	6 59 30 19	7 7 30 53	7 15 31 27	7 23 32 1	7 30 32 35	7 38 33 10	7 46 33 44	7 54 33 58	8 2 34 12	8 10 34 26	8 18 34 40	8 26 34 54	8 34 35 8	8 42 35 22	8 50 35 36	18	0
36	6 50 29 45	6 58 30 19	7 5 30 53	7 13 31 27	7 21 32 1	7 28 32 36	7 36 33 10	7 44 33 44	7 52 33 58	7 60 34 12	7 68 34 26	7 76 34 40	8 4 34 54	8 12 35 8	8 20 35 22	8 28 35 36	19	0
38	6 48 29 45	6 56 30 19	7 3 30 53	7 11 31 27	7 19 32 2	7 26 32 36	7 34 33 10	7 42 33 44	7 50 33 58	7 58 34 12	8 6 34 26	8 14 34 40	8 22 34 54	8 30 35 8	8 38 35 22	8 46 35 36	20	0
40	6 46 29 45	6 54 30 19	7 1 30 53	7 9 31 27	7 17 32 2	7 24 32 36	7 32 33 10	7 40 33 44	7 48 33 58	7 56 34 12	8 4 34 26	8 12 34 40	8 20 34 54	8 28 35 8	8 36 35 22	8 44 35 36	21	0
42	6 44 29 45	6 52 30 19	6 59 30 53	7 7 31 28	7 15 32 2	7 22 32 36	7 30 33 10	7 38 33 45	7 46 33 59	7 54 34 13	8 2 34 27	8 10 34 41	8 18 34 55	8 26 35 9	8 34 35 23	8 42 35 37	22	0
44	6 42 29 45	6 50 30 19	6 58 30 54	7 5 31 28	7 13 32 2	7 20 32 36	7 28 33 11	7 36 33 45	7 44 33 59	7 52 34 13	7 60 34 27	7 68 34 41	7 76 34 55	8 4 35 9	8 12 35 23	8 20 35 37	23	0
46	6 41 29 45	6 48 30 19	6 56 30 54	7 3 31 28	7 11 32 2	7 18 32 36	7 26 33 11	7 34 33 45	7 42 33 59	7 50 34 13	7 58 34 27	8 6 34 41	8 14 34 55	8 22 35 9	8 30 35 23	8 38 35 37	24	0
48	6 39 29 45	6 46 30 20	6 54 30 54	7 1 31 28	7 9 32 2	7 16 32 37	7 24 33 11	7 31 33 45	7 39 33 59	7 47 34 13	7 55 34 27	8 3 34 41	8 11 34 55	8 19 35 9	8 27 35 23	8 35 35 37	25	0
50	6 37 29 45	6 44 30 20	6 52 30 54	6 59 31 28	7 7 32 2	7 14 32 37	7 22 33 11	7 29 33 45	7 37 33 59	7 45 34 13	7 53 34 27	7 61 34 41	7 69 34 55	7 77 35 9	7 85 35 23	7 93 35 37	26	0
52	6 35 29 46	6 43 30 20	6 50 30 54	6 57 31 28	7 5 32 3	7 12 32 37	7 20 33 11	7 27 33 45	7 35 33 59	7 43 34 13	7 51 34 27	7 59 34 41	8 7 34 55	8 15 35 9	8 23 35 23	8 31 35 37	27	0
54	6 33 29 46	6 41 30 20	6 48 30 54	6 56 31 29	7 3 32 3	7 10 32 37	7 18 33 11	7 25 33 46	7 33 33 60	7 41 34 14	7 49 34 28	7 57 34 42	8 5 34 56	8 13 35 10	8 21 35 24	8 29 35 38	28	0
56	6 31 29 46	6 39 30 20	6 46 30 54	6 54 31 29	7 1 32 3	7 8 32 37	7 16 33 11	7 23 33 46	7 31 33 60	7 39 34 14	7 47 34 28	7 55 34 42	8 3 34 56	8 11 35 10	8 19 35 24	8 27 35 38	29	0
58	6 30 29 46	6 37 30 20	6 44 30 55	6 52 31 29	6 59 32 3	7 6 32 37	7 14 33 12	7 21 33 46	7 29 33 60	7 37 34 14	7 45 34 28	7 53 34 42	8 1 34 56	8 09 35 10	8 17 35 24	8 25 35 38	30	0
83°	54'	55'	56'	57'	58'	59'	60'	61'									31	0
0'	6 28 29 46	6 35 30 20	6 42 30 55	6 50 31 29	6 57 32 3	7 4 32 38	7 12 33 12	7 19 33 46	7 27 33 60	7 35 34 14	7 43 34 28	7 51 34 42	7 59 34 56	8 7 35 0	8 15 35 14	8 23 35 28	41	5
2	6 26 29 46	6 33 30 21	6 40 30 55	6 48 31 29	6 55 32 3	7 2 32 38	7 10 33 12	7 17 33 46	7 25 33 60	7 33 34 14	7 41 34 28	7 49 34 42	7 57 34 56	8 5 35 0	8 13 35 14	8 21 35 28	42	5
4	6 24 29 46	6 31 30 21	6 39 30 55	6 46 31 29	6 53 32 4	7 0 32 38	7 7 33 12	7 15 33 46	7 23 33 60	7 31 34 14	7 39 34 28	7 47 34 42	7 55 34 56	8 3 35 0	8 11 35 14	8 19 35 28	43	5
6	6 22 29 47	6 29 30 21	6 37 30 55	6 44 31 29	6 51 32 4	6 58 32 38	7 5 33 12	7 13 33 47	7 21 33 61	7 29 34 15	7 37 34 29	7 45 34 43	7 53 34 57	8 1 35 0	8 9 35 14	8 17 35 28	44	5
8	6 20 29 47	6 28 30 21	6 35 30 55	6 42 31 30	6 49 32 4	6 56 32 38	7 3 33 12	7 11 33 47	7 19 33 61	7 27 34 15	7 35 34 29	7 43 34 43	7 51 34 57	7 59 35 0	8 7 35 14	8 15 35 28	45	5
10	6 19 29 47	6 26 30 21	6 33 30 55	6 40 31 30	6 47 32 4	6 54 32 38	7 1 33 12	7 9 33 47	7 17 33 61	7 25 34 15	7 33 34 29	7 41 34 43	7 49 34 57	7 57 35 0	8 5 35 14	8 13 35 28	46	5
12	6 17 29 47	6 24 30 21	6 31 30 56	6 38 31 30	6 45 32 4	6 52 32 38	6 59 33 13	7 6 33 47	7 14 33 61	7 22 34 15	7 30 34 29	7 38 34 43	7 46 34 57	7 54 35 0	8 2 35 14	8 10 35 28	47	5
14	6 15 29 47	6 22 30 21	6 29 30 56	6 36 31 30	6 43 32 4	6 50 32 39	6 57 33 13	7 4 33 47	7 12 33 61	7 20 34 15	7 28 34 29	7 36 34 43	7 44 34 57	7 52 35 0	8 0 35 14	8 08 35 28	48	5
16	6 13 29 47	6 20 30 22	6 27 30 56	6 34 31 30	6 41 32 4	6 48 32 39	6 55 33 13	7 2 33 47	7 10 33 61	7 18 34 15	7 26 34 29	7 34 34 43	7 42 34 57	7 50 35 0	7 58 35 14	8 6 35 28	49	5
18	6 11 29 47	6 18 30 22	6 25 30 56	6 32 31 30	6 39 32 4	6 46 32 39	6 53 33 13	7 0 33 47	7 8 33 61	7 16 34 15	7 24 34 29	7 32 34 43	7 40 34 57	7 48 35 0	7 56 35 14	8 4 35 28	50	5
20	6 9 29 47	6 16 30 22	6 23 30 56	6 30 31 30	6 37 32 5	6 44 32 39	6 51 33 13	6 58 33 47	7 6 33 61	7 14 34 15	7 22 34 29	7 30 34 43	7 38 34 57	7 46 35 0	7 54 35 14	8 2 35 28	51	5
22	6 8 29 48	6 14 30 22	6 21 30 56	6 28 31 31	6 35 32 5	td												

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (84° and 85°)

App Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.		
	54'		55'		56'		57'		58'		59'		60'		61'		"	0	A
84°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	0	A
0'	5 33	29 50	5 39	30 24	5 45	30 59	5 51	31 33	5 58	32 7	6 5	32 42	6 10	33 16	6 17	33 50	1	0	1
2	5 31	29 50	5 37	30 25	5 43	30 59	5 50	31 33	5 56	32 7	6 2	32 42	6 8	33 16	6 15	33 50	2	0	2
4	5 29	29 50	5 35	30 25	5 41	30 59	5 48	31 33	5 54	32 8	6 0	32 42	6 6	33 16	6 12	33 51	3	0	3
6	5 27	29 50	5 33	30 25	5 39	30 59	5 46	31 33	5 52	32 8	5 58	32 42	6 4	33 16	6 10	33 51	4	0	4
8	5 25	29 51	5 31	30 25	5 38	30 59	5 44	31 33	5 50	32 8	5 56	32 42	6 2	33 16	6 8	33 51	5	0	5
10	5 23	29 51	5 30	30 25	5 36	30 59	5 42	31 34	5 48	32 8	5 54	32 42	6 0	33 16	6 6	33 51	6	0	6
12	5 22	29 51	5 28	30 25	5 34	30 59	5 40	31 34	5 46	32 8	5 52	32 42	5 58	33 17	6 4	33 51	7	1	7
14	5 20	29 51	5 26	30 25	5 32	30 59	5 38	31 34	5 44	32 8	5 50	32 42	5 56	33 17	6 2	33 51	8	1	8
16	5 18	29 51	5 24	30 25	5 30	31 0	5 36	31 34	5 42	32 8	5 48	32 42	5 54	33 17	6 0	33 51	9	1	9
18	5 16	29 51	5 22	30 25	5 28	31 0	5 34	31 34	5 40	32 8	5 46	32 43	5 52	33 17	5 58	33 51	10	1	10
20	5 14	29 51	5 20	30 25	5 26	31 0	5 32	31 34	5 38	32 8	5 44	32 43	5 50	33 17	5 56	33 51	11	1	11
22	5 12	29 51	5 18	30 26	5 24	31 0	5 30	31 34	5 36	32 9	5 42	32 43	5 48	33 17	5 54	33 52	12	1	12
24	5 11	29 51	5 16	30 26	5 22	31 0	5 28	31 34	5 34	32 9	5 40	32 43	5 46	33 17	5 52	33 52	13	1	13
26	5 9	29 51	5 14	30 26	5 20	31 0	5 26	31 34	5 32	32 9	5 38	32 43	5 44	33 17	5 49	33 52	14	1	14
28	5 7	29 52	5 13	30 26	5 18	31 0	5 24	31 35	5 30	32 9	5 36	32 43	5 42	33 17	5 47	33 52	15	1	15
30	5 5	29 52	5 11	30 26	5 17	31 0	5 22	31 35	5 28	32 9	5 34	32 43	5 40	33 18	5 45	33 52	16	1	16
32	5 3	29 52	5 9	30 26	5 15	31 0	5 20	31 35	5 26	32 9	5 32	32 43	5 37	33 18	5 43	33 52	17	1	17
34	5 1	29 52	5 7	30 26	5 13	31 1	5 18	31 35	5 24	32 9	5 30	32 43	5 35	33 18	5 41	33 52	18	1	18
36	4 59	29 52	5 5	30 26	5 11	31 1	5 16	31 35	5 22	32 9	5 28	32 44	5 33	33 18	5 39	33 52	19	1	19
38	4 58	29 52	5 3	30 26	5 9	31 1	5 15	31 35	5 20	32 9	5 26	32 44	5 31	33 18	5 37	33 52	20	1	20
40	4 56	29 52	5 1	30 26	5 7	31 1	5 13	31 35	5 18	32 9	5 24	32 44	5 29	33 18	5 35	33 52	21	1	21
42	4 54	29 52	5 0	30 27	5 5	31 1	5 11	31 35	5 16	32 10	5 22	32 44	5 27	33 18	5 33	33 53	22	1	22
44	4 52	29 52	4 58	30 27	5 3	31 1	5 9	31 35	5 14	32 10	5 20	32 44	5 25	33 18	5 31	33 53	23	1	23
46	4 50	29 52	4 56	30 27	5 1	31 1	5 7	31 35	5 12	32 10	5 18	32 44	5 23	33 19	5 29	33 53	24	1	24
48	4 48	29 53	4 54	30 27	4 59	31 1	5 5	31 36	5 10	32 10	5 16	32 44	5 21	33 19	5 27	33 53	25	1	25
50	4 47	29 53	4 53	30 27	4 57	31 1	5 3	31 36	5 8	32 10	5 14	32 44	5 19	33 19	5 25	33 53	26	1	26
52	4 45	29 53	4 50	30 27	4 56	31 1	5 1	31 36	5 6	32 10	5 12	32 44	5 17	33 19	5 22	33 53	27	1	27
54	4 43	29 53	4 48	30 27	4 54	31 2	4 59	31 36	5 4	32 10	5 10	32 45	5 15	33 19	5 20	33 53	28	1	28
56	4 41	29 53	4 46	30 27	4 52	31 2	4 57	31 36	5 2	32 10	5 8	32 45	5 13	33 19	5 18	33 53	29	1	29
58	4 39	29 53	4 44	30 27	4 50	31 2	4 55	31 36	5 0	32 10	5 6	32 45	5 11	33 19	5 16	33 53	30	1	30
85°	54'	55'	56'	57'	58'	59'	60'	61'											
0'	4 37	29 53	4 43	30 28	4 48	31 2	4 53	31 36	4 58	32 11	5 3	32 45	5 9	33 19	5 14	33 54	31	1	31
2	4 36	29 53	4 41	30 28	4 46	31 2	4 51	31 36	4 56	32 11	5 1	32 45	5 7	33 19	5 12	33 54	32	1	32
4	4 34	29 53	4 39	30 28	4 44	31 2	4 49	31 36	4 54	32 11	5	32 45	5 5	33 19	5 10	33 54	33	1	33
6	4 32	29 53	4 37	30 28	4 42	31 2	4 47	31 36	4 52	32 11	5	32 45	5 3	33 20	5 8	33 54	34	1	34
8	4 30	29 54	4 35	30 28	4 40	31 2	4 45	31 37	4 50	32 11	5	32 45	5 1	33 20	5 6	33 54	35	1	35
10	4 28	29 54	4 33	30 28	4 38	31 2	4 43	31 37	4 48	32 11	5	32 45	5	33 20	5 4	33 54	36	1	36
12	4 26	29 54	4 31	30 28	4 36	31 2	4 41	31 37	4 46	32 11	5	32 45	5	33 20	5 1	33 54	37	1	37
14	4 24	29 54	4 29	30 28	4 34	31 2	4 39	31 37	4 44	32 11	5	32 46	5	33 20	5	33 54	38	1	38
16	4 23	29 54	4 28	30 28	4 33	31 3	4 37	31 37	4 42	32 11	5	32 46	5	33 20	5	33 54	39	1	39
18	4 21	29 54	4 26	30 28	4 31	31 3	4 36	31 37	4 40	32 11	5	32 46	5	33 20	5	33 54	40	1	40
20	4 19	29 54	4 24	30 28	4 29	31 3	4 34	31 37	4 38	32 11	5	32 46	5	33 20	5	33 54	41	1	41
22	4 17	29 54	4 22	30 28	4 27	31 3	4 32	31 37	4 36	32 11	5	32 46	5	33 20	5	33 54	42	1	42
24	4 15	29 54	4 20	30 29	4 25	31 3	4 30	31 37	4 34	32 12	5	32 46	5	33 20	5	33 54	43	1	43
26	4 13	29 54	4 18	30 29	4 23	31 3	4 28	31 37	4 32	32 12	5	32 46	5	33 20	5	33 54	44	1	44
28	4 12	29 54	4 16	30 29	4 21	31 3	4 26	31 37	4 30	32 12	5	32 46	5	33 20	5	33 54	45	1	45
30	4 10	29 54	4 14	30 29	4 19	31 3	4 24	31 37	4 28	32 12	5	32 46	5	33 20	5	33 54	46	1	46
32	4 8	29 54	4 13	30 29	4 17	31 3	4 22	31 38	4 27	32 12	5	32 46	5	33 20	5	33 54	47	1	47
34	4 6	29 54	4 11	30 29	4 15	31 3	4 20	31 38	4 25	32 12	5	32 46	5	33 20	5	33 54	48	1	48
36	4 4	29 55	4 9	30 29	4 13	31 3	4 18	31 38	4 23	32 12	5	32 46	5	33 20	5	33 54	49	1	49
38	4 2	29 55	4 7	30 29	4 12	31 3	4 16	31 38	4 21	32 12	5	32 47	5	33 21	5	33 55	50	1	50
40	4 0	29 55	4 5	30 29	4 10	31 3	4 14	31 38	4 19	32 12	5	32 47	5	33 21	5	33 55	51	1	51
42	3 59	29 55	4 3	30 29	4 8	31 3	4 12	31 38	4 17	32 12	5	32 47	5	33 21	5	33 55	52	1	52
44	3 57	29 55	4 1	30 29	4 6	31 4	4 10	31 38	4 15	32 12	5	32 47	5	33 21	5	33 55	53	1	53
46	3 55	29 55	3 59	30 29	4 4	31 4	4 8	31 38	4 13	32 12	5	32 47	5	33 21	5	33 55	54	1	54
48	3 53	29 55	3 57	30 29	4 2	31 4	4 6	31 38	4 11	32 13	5	32 47	5	33 21	5	33 55	55	1	55
50	3 51	29 55	3 56	30 29	4 0	31 4	4 4	31 38	4 9	32 13	5	32 47	5	33 21	5	33 55	56	1	56
52	3 49	29 55	3 54	30 30	3 58	31 4	4 2	31 38	4 7	32 13	5	32 47	5	33 21	5	33 55	57	1	57
54	3 48	29 55	3 52	30 30	3 56	31 4	4 0	31 38	4 5	32 13	5	32 47	5	33 22	5	33 55	58	1	58
56	3 46	29 55	3 50	30 30	3 54	31 4	3 58	31 39	4 3	32 13	5	32 47	5	33 22	5	33 55	59	1	59
58	3 44	29 55	3 48	30 30	3 52	31 4	3 57	31 39	4 1	32 13	5	32 47	5	33 22	5	33 55	60	1	60

(86° and 87°) The Correction of the Moon's Altitude, and the Aux. Angle A.

(w.)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'		55'		56'		57'		58'		59'		60'		61'		"	A
86°	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	Corr.	A	"	A
	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	+	60°	1	0
0'	3 42	29 55	3 46	30 30	3 50	31 4	3 55	31 39	3 59	32 13	4 3	32 47	4 7	33 22	4 11	33 56	2	0
2	3 40	29 56	3 44	30 30	3 48	31 4	3 53	31 39	3 57	32 13	4 1	32 48	4 5	33 22	4 9	33 56	3	0
4	3 38	29 56	3 42	30 30	3 47	31 4	3 51	31 39	3 55	32 13	3 59	32 48	4 3	33 22	4 7	33 56	5	0
6	3 36	29 56	3 40	30 30	3 45	31 4	3 49	31 39	3 53	32 13	3 57	32 48	4 1	33 22	4 5	33 56	7	0
8	3 35	29 56	3 39	30 30	3 43	31 4	3 47	31 39	3 51	32 13	3 55	32 48	3 59	33 22	4 3	33 56	9	0
10	3 33	29 56	3 37	30 30	3 41	31 5	3 45	31 39	3 49	32 13	3 53	32 48	3 57	33 22	4 1	33 56	11	0
12	3 31	29 56	3 35	30 30	3 39	31 5	3 43	31 39	3 47	32 13	3 51	32 48	3 55	33 22	3 59	33 57	13	0
14	3 29	29 56	3 33	30 30	3 37	31 5	3 41	31 39	3 45	32 13	3 49	32 48	3 53	33 22	3 57	33 57	15	0
16	3 27	29 56	3 31	30 30	3 35	31 5	3 39	31 39	3 43	32 13	3 47	32 48	3 51	33 22	3 54	33 57	17	0
18	3 25	29 56	3 29	30 30	3 33	31 5	3 37	31 39	3 41	32 14	3 45	32 48	3 49	33 22	3 52	33 57	19	0
20	3 23	29 56	3 27	30 30	3 31	31 5	3 35	31 39	3 39	32 14	3 43	32 48	3 46	33 22	3 50	33 57	21	0
22	3 22	29 56	3 25	30 30	3 29	31 5	3 33	31 39	3 37	32 14	3 41	32 48	3 44	33 22	3 48	33 57	23	0
24	3 20	29 56	3 24	30 30	3 27	31 5	3 31	31 39	3 35	32 14	3 39	32 48	3 42	33 22	3 46	33 57	25	0
26	3 18	29 56	3 22	30 31	3 25	31 5	3 29	31 39	3 33	32 14	3 37	32 48	3 40	33 23	3 44	33 57	27	0
28	3 16	29 56	3 20	30 31	3 24	31 5	3 27	31 39	3 31	32 14	3 35	32 48	3 38	33 23	3 42	33 57	29	0
30	3 14	29 56	3 18	30 31	3 22	31 5	3 25	31 39	3 29	32 14	3 32	32 48	3 36	33 23	3 40	33 57	31	0
32	3 12	29 56	3 16	30 31	3 20	31 5	3 23	31 39	3 27	32 14	3 30	32 48	3 34	33 23	3 38	33 57	33	0
34	3 11	29 56	3 14	30 31	3 18	31 5	3 21	31 40	3 25	32 14	3 28	32 48	3 32	33 23	3 36	33 57	35	0
36	3 9	29 56	3 12	30 31	3 16	31 5	3 19	31 40	3 23	32 14	3 26	32 48	3 30	33 23	3 34	33 57	37	0
38	3 7	29 56	3 10	30 31	3 14	31 5	3 17	31 40	3 21	32 14	3 24	32 48	3 28	33 23	3 31	33 57	39	0
40	3 5	29 56	3 8	30 31	3 12	31 5	3 15	31 40	3 19	32 14	3 22	32 48	3 26	33 23	3 29	33 57	41	0
42	3 3	29 57	3 7	30 31	3 10	31 5	3 13	31 40	3 17	32 14	3 20	32 49	3 24	33 23	3 27	33 57	43	0
44	3 1	29 57	3 5	30 31	3 8	31 5	3 12	31 40	3 15	32 14	3 18	32 49	3 22	33 23	3 25	33 57	45	0
46	2 59	29 57	3 3	30 31	3 6	31 5	3 10	31 40	3 13	32 14	3 16	32 49	3 20	33 23	3 23	33 57	47	0
48	2 58	29 57	3 1	30 31	3 4	31 5	3 8	31 40	3 11	32 14	3 14	32 49	3 18	33 23	3 21	33 58	49	0
50	2 56	29 57	2 59	30 31	3 2	31 6	3 6	31 40	3 9	32 14	3 12	32 49	3 16	33 23	3 19	33 58	51	0
52	2 54	29 57	2 57	30 31	3 0	31 6	3 4	31 40	3 7	32 14	3 10	32 49	3 14	33 23	3 17	33 58	53	0
54	2 52	29 57	2 55	30 31	2 59	31 6	3 2	31 40	3 5	32 14	3 8	32 49	3 11	33 23	3 15	33 58	55	0
56	2 50	29 57	2 53	30 31	2 57	31 6	3 0	31 40	3 3	32 14	3 6	32 49	3 9	33 23	3 13	33 58	57	0
58	2 48	29 57	2 51	30 31	2 55	31 6	2 58	31 40	3 1	32 15	3 4	32 49	3 7	33 23	3 11	33 58	59	0
87°	54'	55'	56'	57'	58'	59'	60'	61'										
0'	2 46	29 57	2 50	30 31	2 53	31 6	2 56	31 40	2 59	32 15	3 2	32 49	3 5	33 23	3 8	33 58	1	0
2	2 45	29 57	2 48	30 31	2 51	31 6	2 54	31 40	2 57	32 15	3 0	32 49	3 3	33 24	3 6	33 58	3	0
4	2 43	29 57	2 46	30 32	2 49	31 6	2 52	31 40	2 55	32 15	2 58	32 49	3 1	33 24	3 4	33 58	5	0
6	2 41	29 57	2 44	30 32	2 47	31 6	2 50	31 40	2 53	32 15	2 56	32 49	2 59	33 24	3 2	33 58	7	0
8	2 39	29 57	2 42	30 32	2 45	31 6	2 48	31 41	2 51	32 15	2 54	32 49	2 57	33 24	3 0	33 58	9	0
10	2 37	29 57	2 40	30 32	2 43	31 6	2 46	31 41	2 49	32 15	2 52	32 49	2 55	33 24	2 58	33 58	11	0
12	2 35	29 57	2 38	30 32	2 41	31 6	2 44	31 41	2 47	32 15	2 50	32 50	2 53	33 24	2 56	33 58	13	0
14	2 34	29 57	2 36	30 32	2 39	31 6	2 42	31 41	2 45	32 15	2 48	32 50	2 51	33 24	2 54	33 58	15	0
16	2 32	29 58	2 35	30 32	2 37	31 6	2 40	31 41	2 43	32 15	2 46	32 50	2 49	33 24	2 52	33 59	17	0
18	2 30	29 58	2 33	30 32	2 36	31 7	2 38	31 41	2 41	32 15	2 44	32 50	2 47	33 24	2 50	33 59	19	0
20	2 28	29 58	2 31	30 32	2 34	31 7	2 36	31 41	2 39	32 15	2 42	32 50	2 45	33 24	2 48	33 59	21	0
22	2 26	29 58	2 29	30 32	2 32	31 7	2 34	31 41	2 37	32 16	2 40	32 50	2 43	33 24	2 46	33 59	23	0
24	2 24	29 58	2 27	30 32	2 30	31 7	2 32	31 41	2 35	32 16	2 38	32 50	2 41	33 24	2 43	33 59	25	0
26	2 22	29 58	2 25	30 32	2 28	31 7	2 31	31 41	2 33	32 16	2 36	32 50	2 39	33 25	2 41	33 59	27	0
28	2 21	29 58	2 23	30 32	2 26	31 7	2 29	31 41	2 31	32 16	2 34	32 50	2 37	33 25	2 39	33 59	29	0
30	2 19	29 58	2 21	30 32	2 24	31 7	2 27	31 41	2 29	32 16	2 32	32 50	2 35	33 25	2 37	33 59	31	0
32	2 17	29 58	2 20	30 33	2 22	31 7	2 25	31 42	2 27	32 16	2 30	32 50	2 32	33 25	2 35	33 59	33	0
34	2 15	29 58	2 18	30 33	2 20	31 7	2 23	31 42	2 25	32 16	2 28	32 51	2 30	33 25	2 33	33 59	35	0
36	2 13	29 58	2 16	30 33	2 18	31 7	2 21	31 42	2 23	32 16	2 26	32 51	2 28	33 25	2 31	34 0	37	0
38	2 11	29 58	2 14	30 33	2 16	31 7	2 19	31 42	2 21	32 16	2 24	32 51	2 26	33 25	2 29	34 0	39	0
40	2 10	29 58	2 12	30 33	2 14	31 7	2 17	31 42	2 19	32 16	2 22	32 51	2 24	33 25	2 27	34 0	41	0
42	2 8	29 59	2 10	30 33	2 13	31 7	2 15	31 42	2 17	32 16	2 20	32 51	2 22	33 25	2 25	34 0	43	0
44	2 6	29 59	2 8	30 33	2 11	31 8	2 13	31 42	2 15	32 16	2 18	32 51	2 20	33 25	2 23	34 0	45	0
46	2 4	29 59	2 6	30 33	2 9	31 8	2 11	31 42	2 13	32 17	2 16	32 51	2 18	33 25	2 20	34 0	47	0
48	2 2	29 59	2 4	30 33	2 7	31 8	2 9	31 42	2 11	32 17	2 14	32 51	2 16	33 26	2 18	34 0	49	0
50	2 0	29 59	2 3	30 33	2 5	31 8	2 7	31 42	2 9	32 17	2 12	32 51	2 14	33 26	2 16	34 0	51	0
52	1 58	29 59	2 1	30 33	2 3	31 8	2 5	31 42	2 7	32 17	2 10	32 51	2 12	33 26	2 14	34 0	53	0
54	1 57	29 59	1 59	30 34	2 1	31 8	2 3	31 43	2 5	32 17	2 8	32 51	2 10	33 26	2 12	34 0	55	0
56	1 55	29 59	1 57	30 34	1 59	31 8	2 1	31 43	2 3	32 17	2 6	32 52	2 8	33 26	2 10	34 0	57	0
58	1 53	29 59	1 55	30 34	1 57	31 8	1 59	31 43	2 1	32 17	2 4	32 52	2 6	33 26	2 8	34 0	59	0

(w.) The Correction of the Moon's Altitude, and the Aux. Angle A. (88° and 89°)

App. Alt.	Minutes of Moon's Hor. Parallax.																Seconds of H. P.	
	54'	55'	56'	57'	58'	59'	60'	61'									"	"
88	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	Corr. +	A 60°	"	"
0'	1 51 29 59	1 53 30 34	1 55 31 8	1 57 31 43	1 59 32 17	2 2 32 52	2 4 33 26	2 6 34 1	1	2	3	4	5	6	7	8	0	1
2	1 49 29 59	1 51 30 34	1 53 31 8	1 55 31 43	1 58 32 17	2 0 32 52	2 2 33 26	2 4 34 1	1	2	3	4	5	6	7	8	0	2
4	1 47 29 59	1 49 30 34	1 51 31 8	1 53 31 43	1 56 32 17	1 58 32 52	2 0 33 26	2 2 34 1	1	2	3	4	5	6	7	8	0	3
6	1 46 29 59	1 48 30 34	1 50 31 8	1 52 31 43	1 55 32 17	1 56 32 52	1 58 33 26	1 59 34 1	1	2	3	4	5	6	7	8	0	3
8	1 44 29 59	1 46 30 34	1 48 31 8	1 50 31 43	1 52 32 17	1 53 32 52	1 55 33 26	1 57 34 1	1	2	3	4	5	6	7	8	0	4
10	1 42 29 59	1 44 30 34	1 46 31 8	1 48 31 43	1 50 32 17	1 51 32 52	1 53 33 26	1 55 34 1	1	2	3	4	5	6	7	8	0	5
12	1 40 29 59	1 42 30 34	1 44 31 8	1 46 31 43	1 48 32 17	1 49 32 52	1 51 33 26	1 53 34 1	1	2	3	4	5	6	7	8	0	6
14	1 38 29 59	1 40 30 34	1 42 31 9	1 44 31 43	1 46 32 17	1 47 32 52	1 49 33 27	1 51 34 1	1	2	3	4	5	6	7	8	0	6
16	1 36 29 59	1 38 30 34	1 40 31 9	1 42 31 43	1 44 32 18	1 45 32 52	1 47 33 27	1 49 34 1	1	2	3	4	5	6	7	8	0	7
18	1 34 29 59	1 36 30 34	1 38 31 9	1 40 31 43	1 42 32 18	1 43 32 52	1 45 33 27	1 47 34 1	1	2	3	4	5	6	7	8	0	8
20	1 33 29 59	1 34 30 34	1 36 31 9	1 38 31 43	1 40 32 18	1 41 32 52	1 43 33 27	1 45 34 1	1	2	3	4	5	6	7	8	0	9
22	1 31 30 0	1 32 30 34	1 34 31 9	1 36 31 43	1 38 32 18	1 39 32 52	1 41 33 27	1 43 34 1	1	2	3	4	5	6	7	8	0	9
24	1 29 30 0	1 31 30 34	1 32 31 9	1 34 31 43	1 36 32 18	1 37 32 52	1 39 33 27	1 41 34 1	1	2	3	4	5	6	7	8	0	10
26	1 27 30 0	1 29 30 34	1 30 31 9	1 32 31 43	1 34 32 18	1 35 32 52	1 37 33 27	1 39 34 1	1	2	3	4	5	6	7	8	0	11
28	1 25 30 0	1 27 30 34	1 28 31 9	1 30 31 43	1 32 32 18	1 33 32 52	1 35 33 27	1 36 34 1	1	2	3	4	5	6	7	8	0	11
30	1 23 30 0	1 25 30 34	1 26 31 9	1 28 31 43	1 30 32 18	1 31 32 52	1 33 33 27	1 34 34 1	1	2	3	4	5	6	7	8	0	12
32	1 21 30 0	1 23 30 34	1 25 31 9	1 26 31 43	1 28 32 18	1 29 32 52	1 31 33 27	1 32 34 1	1	2	3	4	5	6	7	8	0	13
34	1 20 30 0	1 21 30 34	1 23 31 9	1 24 31 43	1 26 32 18	1 27 32 52	1 29 33 27	1 30 34 1	1	2	3	4	5	6	7	8	0	13
36	1 18 30 0	1 19 30 34	1 21 31 9	1 22 31 43	1 24 32 18	1 25 32 52	1 27 33 27	1 28 34 1	1	2	3	4	5	6	7	8	0	14
38	1 16 30 0	1 17 30 34	1 19 31 9	1 20 31 43	1 22 32 18	1 23 32 53	1 25 33 27	1 26 34 1	1	2	3	4	5	6	7	8	0	15
40	1 14 30 0	1 15 30 34	1 17 31 9	1 18 31 43	1 20 32 18	1 21 32 53	1 23 33 27	1 24 34 1	1	2	3	4	5	6	7	8	0	16
42	1 12 30 0	1 14 30 34	1 15 31 9	1 16 31 44	1 18 32 18	1 19 32 53	1 20 33 27	1 22 34 1	1	2	3	4	5	6	7	8	0	16
44	1 10 30 0	1 12 30 34	1 13 31 9	1 14 31 44	1 16 32 18	1 17 32 53	1 18 33 27	1 20 34 1	1	2	3	4	5	6	7	8	0	17
46	1 9 30 0	1 10 30 34	1 11 31 9	1 12 31 44	1 14 32 18	1 15 32 53	1 16 33 27	1 18 34 1	1	2	3	4	5	6	7	8	0	18
48	1 7 30 0	1 8 30 34	1 9 31 9	1 10 31 44	1 12 32 18	1 13 32 53	1 14 33 27	1 15 34 1	1	2	3	4	5	6	7	8	0	18
50	1 5 30 0	1 6 30 34	1 7 31 9	1 8 31 44	1 10 32 18	1 11 32 53	1 12 33 27	1 13 34 1	1	2	3	4	5	6	7	8	0	19
52	1 3 30 0	1 4 30 34	1 5 31 9	1 7 31 44	1 8 32 18	1 9 32 53	1 10 33 28	1 11 34 1	1	2	3	4	5	6	7	8	0	20
54	1 1 30 0	1 2 30 34	1 3 31 9	1 5 31 44	1 6 32 18	1 7 32 53	1 8 33 28	1 9 34 1	1	2	3	4	5	6	7	8	0	21
56	0 59 30 0	1 0 30 34	1 2 31 9	1 3 31 44	1 4 32 18	1 5 32 53	1 6 33 28	1 7 34 1	1	2	3	4	5	6	7	8	0	21
58	0 57 30 0	0 58 30 34	1 0 31 9	1 1 31 44	1 2 32 18	1 3 32 53	1 4 33 28	1 5 34 1	1	2	3	4	5	6	7	8	0	22
89°	54'	55'	56'	57'	58'	59'	60'	61'	40	41	42	43	44	45	46	47	48	49
0'	0 56 30 0	0 57 30 34	0 58 31 9	0 59 31 44	1 0 32 18	1 1 32 53	1 2 33 28	1 3 34 1	2	3	4	5	6	7	8	9	0	1
2	0 54 30 0	0 55 30 34	0 56 31 9	0 57 31 44	0 58 32 18	0 59 32 53	1 0 33 28	1 1 34 1	2	3	4	5	6	7	8	9	0	2
4	0 52 30 0	0 53 30 34	0 54 31 9	0 55 31 44	0 56 32 18	0 57 32 53	0 58 33 28	0 59 34 1	2	3	4	5	6	7	8	9	0	3
6	0 50 30 0	0 51 30 34	0 52 31 9	0 53 31 44	0 54 32 18	0 55 32 53	0 56 33 28	0 57 34 1	2	3	4	5	6	7	8	9	0	4
8	0 48 30 0	0 49 30 34	0 50 31 9	0 51 31 44	0 52 32 18	0 53 32 53	0 54 33 28	0 55 34 1	2	3	4	5	6	7	8	9	0	5
10	0 47 30 0	0 47 30 34	0 48 31 9	0 49 31 44	0 50 32 18	0 51 32 53	0 52 33 28	0 53 34 1	2	3	4	5	6	7	8	9	0	6
12	0 45 30 0	0 46 30 34	0 46 31 9	0 47 31 44	0 48 32 18	0 49 32 53	0 50 33 28	0 51 34 1	2	3	4	5	6	7	8	9	0	7
14	0 43 30 0	0 44 30 35	0 45 31 9	0 46 31 44	0 47 32 18	0 48 32 53	0 49 33 28	0 50 34 1	2	3	4	5	6	7	8	9	0	8
16	0 41 30 0	0 42 30 35	0 43 31 9	0 44 31 44	0 45 32 18	0 46 32 53	0 47 33 28	0 48 34 1	2	3	4	5	6	7	8	9	0	9
18	0 39 30 0	0 40 30 35	0 41 31 9	0 42 31 44	0 43 32 18	0 44 32 53	0 45 33 28	0 46 34 1	2	3	4	5	6	7	8	9	0	10
20	0 38 30 0	0 38 30 35	0 39 31 9	0 40 31 44	0 41 32 18	0 42 32 53	0 43 33 28	0 44 34 1	2	3	4	5	6	7	8	9	0	11
22	0 36 30 0	0 36 30 35	0 37 31 9	0 38 31 44	0 39 32 18	0 40 32 53	0 41 33 28	0 42 34 1	2	3	4	5	6	7	8	9	0	12
24	0 34 30 0	0 35 30 35	0 35 31 9	0 36 31 44	0 37 32 18	0 38 32 53	0 39 33 28	0 40 34 1	2	3	4	5	6	7	8	9	0	13
26	0 32 30 0	0 33 30 35	0 33 31 9	0 34 31 44	0 35 32 18	0 36 32 53	0 37 33 28	0 38 34 1	2	3	4	5	6	7	8	9	0	14
28	0 31 30 0	0 31 30 35	0 31 31 10	0 32 31 44	0 33 32 18	0 34 32 53	0 35 33 28	0 36 34 1	2	3	4	5	6	7	8	9	0	15
30	0 29 30 0	0 29 30 35	0 30 31 10	0 31 31 44	0 32 32 18	0 33 32 53	0 34 33 28	0 35 34 1	2	3	4	5	6	7	8	9	0	16
32	0 27 30 0	0 27 30 35	0 28 31 10	0 29 31 44	0 30 32 18	0 31 32 53	0 32 33 28	0 33 34 1	2	3	4	5	6	7	8	9	0	17
34	0 25 30 0	0 26 30 35	0 26 31 10	0 27 31 44	0 28 32 18	0 29 32 53	0 30 33 28	0 31 34 1	2	3	4	5	6	7	8	9	0	18
36	0 23 30 0	0 24 30 35	0 24 31 10	0 25 31 44	0 26 32 18	0 27 32 53	0 28 33 28	0 29 34 1	2	3	4	5	6	7	8	9	0	19
38	0 22 30 0	0 22 30 35	0 22 31 10	0 23 31 44	0 24 32 18	0 25 32 53	0 26 33 28	0 27 34 1	2	3	4	5	6	7	8	9	0	20
40	0 20 30 0	0 20 30 35	0 20 31 10	0 21 31 44	0 22 32 18	0 23 32 53	0 24 33 28	0 25 34 1	2	3	4	5	6	7	8	9	0	21
42	0 18 30 0	0 18 30 35	0 18 31 10	0 19 31 44	0 20 32 18	0 21 32 53	0 22 33 28	0 23 34 1	2	3	4	5	6	7	8	9	0	22
44	0 16 30 0	0 16 30 35	0 16 31 10	0 17 31 44	0 18 32 18	0 19 32 53	0 20 33 28	0 21 34 1	2	3	4	5	6	7	8	9	0	23
46	0 15 30 0	0 15 30 35	0 15 31 10	0 16 31 44	0 17 32 18	0 18 32 53	0 19 33 28	0 20 34 1	2	3	4	5	6	7	8	9	0	24
48	0 13 30 0	0 13 30 35	0 13 31 10	0 14 31 44	0 15 32 18	0 16 32 53	0 17 33 28	0 18 34 1	2	3	4	5	6	7	8	9	0	25
50	0 11 30 0	0 11 30 35	0 11 31 10	0 12 31 44	0 13 32 18	0 14 32 53	0 15 33 28	0 16 34 1	2	3	4	5	6	7	8	9	0	26
52	0 9 30 0	0 9 30 35	0 9 31 10	0 10 31 44	0 11 32 18	0 12 32 53	0 13 33 28	0 14 34 1	2	3	4	5	6	7	8	9	0	27
54	0 7 30 0	0 7 30 35	0 7 31 10	0 8 31 44	0 9 32 18	0 10 32 53	0 11 33 28	0 12 34 1	2	3	4	5	6	7	8	9	0	28
56	0 6 30 0	0 6 30 35	0 6 31 10	0 7 31 44	0 8 32 18	0 9 32 53	0 10 33 28	0 11 34 1	2	3	4	5	6	7	8	9	0	29
58	0 4 30 0	0 4 30 35	0 4 31 10	0 5 31 44	0 6 32 18	0 7 32 53	0 8 33 28	0 9 34 1	2	3	4	5	6	7	8	9	0	30

Traverse Table.

(x.)

Distance.		1		2		3		4		5		6		7		8		Crse.
Crse.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crse.	
1	01.0 00.0	02.0 00.1	03.0 00.1	04.0 00.2	05.0 00.2	06.0 00.3	07.0 00.3	08.0 00.4	7	01.0 00.2	02.0 00.4	03.0 00.6	04.0 00.8	05.0 01.0	06.0 01.2	07.0 01.4	08.0 01.6	7
1	01.0 00.1	02.0 00.2	03.0 00.3	04.0 00.4	05.0 00.5	06.0 00.6	07.0 00.7	08.0 00.8	7	01.0 00.2	02.0 00.3	03.0 00.4	04.0 00.5	05.0 00.6	06.0 00.7	07.0 00.8	08.0 00.9	7
1	01.0 00.1	02.0 00.3	03.0 00.4	04.0 00.6	04.9 00.7	05.9 00.9	06.9 01.0	07.9 01.2	7	01.0 00.2	02.0 00.4	03.0 00.6	04.0 00.8	04.9 01.0	05.9 01.2	06.9 01.4	07.9 01.6	7
1	01.0 00.2	02.0 00.4	02.9 00.6	03.9 00.8	04.9 01.0	05.9 01.2	06.9 01.4	07.8 01.6	7	01.0 00.2	02.0 00.4	02.9 00.6	03.9 00.8	04.9 01.0	05.9 01.2	06.9 01.4	07.8 01.6	7
1	01.0 00.2	02.0 00.5	02.9 00.7	03.9 01.0	04.9 01.2	05.8 01.5	06.8 01.7	07.8 01.9	7	01.0 00.2	02.0 00.5	02.9 00.7	03.9 01.0	04.9 01.2	05.8 01.5	06.8 01.7	07.8 01.9	7
1	01.0 00.3	02.0 00.6	02.9 00.9	03.8 01.2	04.8 01.5	05.7 01.7	06.7 02.0	07.7 02.3	7	01.0 00.3	02.0 00.6	02.9 00.9	03.8 01.2	04.8 01.5	05.7 01.7	06.7 02.0	07.7 02.3	7
1	00.9 00.3	01.9 00.7	02.8 01.0	03.8 01.3	04.7 01.7	05.6 02.0	06.6 02.4	07.5 02.7	7	00.9 00.3	01.9 00.7	02.8 01.0	03.8 01.3	04.7 01.7	05.6 02.0	06.6 02.4	07.5 02.7	7
2	00.9 00.4	01.8 00.8	02.8 01.1	03.7 01.5	04.6 01.9	05.5 02.3	06.5 02.7	07.4 03.1	6	00.9 00.4	01.8 00.8	02.8 01.1	03.7 01.5	04.6 01.9	05.5 02.3	06.5 02.7	07.4 03.1	6
2	00.9 00.4	01.8 00.9	02.7 01.3	03.6 01.7	04.5 02.1	05.4 02.6	06.3 03.0	07.2 03.4	6	00.9 00.4	01.8 00.9	02.7 01.3	03.6 01.7	04.5 02.1	05.4 02.6	06.3 03.0	07.2 03.4	6
2	00.9 00.5	01.8 00.9	02.6 01.4	03.5 01.9	04.4 02.4	05.3 02.8	06.2 03.3	07.1 03.8	6	00.9 00.5	01.8 00.9	02.6 01.4	03.5 01.9	04.4 02.4	05.3 02.8	06.2 03.3	07.1 03.8	6
2	00.9 00.5	01.7 01.0	02.6 01.5	03.4 02.1	04.3 02.6	05.1 03.1	06.0 03.6	06.9 04.1	6	00.9 00.5	01.7 01.0	02.6 01.5	03.4 02.1	04.3 02.6	05.1 03.1	06.0 03.6	06.9 04.1	6
3	00.8 00.6	01.7 01.1	02.5 01.7	03.3 02.2	04.2 02.8	05.0 03.3	05.8 03.9	06.7 04.4	5	00.8 00.6	01.7 01.1	02.5 01.7	03.3 02.2	04.2 02.8	05.0 03.3	05.8 03.9	06.7 04.4	5
3	00.8 00.6	01.6 01.2	02.4 01.8	03.2 02.4	04.0 03.0	04.8 03.6	05.6 04.2	06.4 04.8	5	00.8 00.6	01.6 01.2	02.4 01.8	03.2 02.4	04.0 03.0	04.8 03.6	05.6 04.2	06.4 04.8	5
3	00.8 00.6	01.5 01.3	02.3 01.9	03.1 02.5	03.9 03.2	04.6 03.8	05.4 04.4	06.2 05.1	5	00.8 00.6	01.5 01.3	02.3 01.9	03.1 02.5	03.9 03.2	04.6 03.8	05.4 04.4	06.2 05.1	5
3	00.7 00.7	01.5 01.3	02.2 02.0	03.0 02.7	03.7 03.4	04.4 04.0	05.2 04.7	05.9 05.4	5	00.7 00.7	01.5 01.3	02.2 02.0	03.0 02.7	03.7 03.4	04.4 04.0	05.2 04.7	05.9 05.4	5
4	00.7 00.7	01.4 01.4	02.1 02.1	02.8 02.8	03.5 03.5	04.2 04.2	04.9 04.9	05.7 05.7	4	00.7 00.7	01.4 01.4	02.1 02.1	02.8 02.8	03.5 03.5	04.2 04.2	04.9 04.9	05.7 05.7	4
10	01.0 00.0	02.0 00.0	03.0 00.1	04.0 00.1	05.0 00.1	06.0 00.1	07.0 00.1	08.0 00.1	890	01.0 00.0	02.0 00.0	03.0 00.1	04.0 00.1	05.0 00.1	06.0 00.1	07.0 00.1	08.0 00.1	890
2	01.0 00.0	02.0 00.1	03.0 00.1	04.0 00.1	05.0 00.2	06.0 00.2	07.0 00.2	08.0 00.3	88	01.0 00.0	02.0 00.1	03.0 00.1	04.0 00.1	05.0 00.2	06.0 00.2	07.0 00.2	08.0 00.3	88
3	01.0 00.1	02.0 00.1	03.0 00.2	04.0 00.2	05.0 00.3	06.0 00.3	07.0 00.4	08.0 00.4	87	01.0 00.1	02.0 00.1	03.0 00.2	04.0 00.2	05.0 00.3	06.0 00.3	07.0 00.4	08.0 00.4	87
4	01.0 00.1	02.0 00.1	03.0 00.2	04.0 00.3	05.0 00.3	06.0 00.4	07.0 00.5	08.0 00.6	86	01.0 00.1	02.0 00.1	03.0 00.2	04.0 00.3	05.0 00.3	06.0 00.4	07.0 00.5	08.0 00.6	86
5	01.0 00.1	02.0 00.2	03.0 00.3	04.0 00.3	05.0 00.4	06.0 00.5	07.0 00.6	08.0 00.7	85	01.0 00.1	02.0 00.2	03.0 00.3	04.0 00.3	05.0 00.4	06.0 00.5	07.0 00.6	08.0 00.7	85
6	01.0 00.1	02.0 00.2	03.0 00.3	04.0 00.4	05.0 00.5	06.0 00.6	07.0 00.7	08.0 00.8	84	01.0 00.1	02.0 00.2	03.0 00.3	04.0 00.4	05.0 00.5	06.0 00.6	07.0 00.7	08.0 00.8	84
7	01.0 00.1	02.0 00.2	03.0 00.4	04.0 00.5	05.0 00.6	06.0 00.7	06.9 00.9	07.9 01.0	83	01.0 00.1	02.0 00.2	03.0 00.4	04.0 00.5	05.0 00.6	06.0 00.7	06.9 00.9	07.9 01.0	83
8	01.0 00.1	02.0 00.3	03.0 00.4	04.0 00.6	05.0 00.7	05.9 00.8	06.9 01.0	07.9 01.1	82	01.0 00.1	02.0 00.3	03.0 00.4	04.0 00.6	05.0 00.7	05.9 00.8	06.9 01.0	07.9 01.1	82
9	01.0 00.2	02.0 00.3	03.0 00.5	04.0 00.6	04.9 00.8	05.9 00.9	06.9 01.1	07.9 01.3	81	01.0 00.2	02.0 00.3	03.0 00.5	04.0 00.6	04.9 00.8	05.9 00.9	06.9 01.1	07.9 01.3	81
10	01.0 00.2	02.0 00.3	03.0 00.5	03.9 00.7	04.9 00.9	05.9 01.0	06.9 01.2	07.9 01.4	80	01.0 00.2	02.0 00.3	03.0 00.5	03.9 00.7	04.9 00.9	05.9 01.0	06.9 01.2	07.9 01.4	80
11	01.0 00.2	02.0 00.4	02.9 00.6	03.9 00.8	04.9 01.0	05.9 01.1	06.9 01.3	07.9 01.5	79	01.0 00.2	02.0 00.4	02.9 00.6	03.9 00.8	04.9 01.0	05.9 01.1	06.9 01.3	07.9 01.5	79
12	01.0 00.2	02.0 00.4	02.9 00.6	03.9 00.8	04.9 01.0	05.9 01.2	06.8 01.5	07.8 01.7	78	01.0 00.2	02.0 00.4	02.9 00.6	03.9 00.8	04.9 01.0	05.9 01.2	06.8 01.5	07.8 01.7	78
13	01.0 00.2	01.9 00.4	02.9 00.7	03.9 00.9	04.9 01.1	05.8 01.3	06.8 01.6	07.8 01.8	77	01.0 00.2	01.9 00.4	02.9 00.7	03.9 00.9	04.9 01.1	05.8 01.3	06.8 01.6	07.8 01.8	77
14	01.0 00.2	01.9 00.5	02.9 00.7	03.9 01.0	04.9 01.2	05.8 01.5	06.8 01.7	07.8 01.9	76	01.0 00.2	01.9 00.5	02.9 00.7	03.9 01.0	04.9 01.2	05.8 01.5	06.8 01.7	07.8 01.9	76
15	01.0 00.3	01.9 00.5	02.9 00.8	03.9 01.0	04.8 01.3	05.8 01.6	06.8 01.8	07.7 02.1	75	01.0 00.3	01.9 00.5	02.9 00.8	03.9 01.0	04.8 01.3	05.8 01.6	06.8 01.8	07.7 02.1	75
16	01.0 00.3	01.9 00.6	02.9 00.8	03.8 01.1	04.8 01.4	05.8 01.7	06.7 01.9	07.7 02.2	74	01.0 00.3	01.9 00.6	02.9 00.8	03.8 01.1	04.8 01.4	05.8 01.7	06.7 01.9	07.7 02.2	74
17	01.0 00.3	01.9 00.6	02.9 00.9	03.8 01.2	04.8 01.5	05.7 01.8	06.7 02.0	07.7 02.3	73	01.0 00.3	01.9 00.6	02.9 00.9	03.8 01.2	04.8 01.5	05.7 01.8	06.7 02.0	07.7 02.3	73
18	01.0 00.3	01.9 00.6	02.9 00.9	03.8 01.2	04.8 01.5	05.7 01.9	06.7 02.2	07.6 02.5	72	01.0 00.3	01.9 00.6	02.9 00.9	03.8 01.2	04.8 01.5	05.7 01.9	06.7 02.2	07.6 02.5	72
19	00.9 00.3	01.9 00.7	02.8 01.0	03.8 01.3	04.7 01.6	05.7 02.0	06.6 02.3	07.6 02.6	71	00.9 00.3	01.9 00.7	02.8 01.0	03.8 01.3	04.7 01.6	05.7 02.0	06.6 02.3	07.6 02.6	71
20	00.9 00.3	01.9 00.7	02.8 01.0	03.8 01.4	04.7 01.7	05.6 02.1	06.6 02.4	07.5 02.7	70	00.9 00.3	01.9 00.7	02.8 01.0	03.8 01.4	04.7 01.7	05.6 02.1	06.6 02.4	07.5 02.7	70
21	00.9 00.4	01.9 00.7	02.8 01.1	03.7 01.4	04.7 01.8	05.6 02.2	06.5 02.5	07.5 02.9	69	00.9 00.4	01.9 00.7	02.8 01.1	03.7 01.4	04.7 01.8	05.6 02.2	06.5 02.5	07.5 02.9	69
22	00.9 00.4	01.9 00.7	02.8 01.1	03.7 01.5	04.6 01.9	05.6 02.2	06.5 02.6	07.4 03.0	68	00.9 00.4	01.9 00.7	02.8 01.1	03.7 01.5	04.6 01.9	05.6 02.2	06.5 02.6	07.4 03.0	68
23	00.9 00.4	01.8 00.8	02.8 01.2	03.7 01.6	04.6 02.0	05.5 02.3	06.4 02.7	07.4 03.1	67	00.9 00.4	01.8 00.8	02.8 01.2	03.7 01.6	04.6 02.0	05.5 02.3	06.4 02.7	07.4 03.1	67
24	00.9 00.4	01.8 00.8	02.7 01.2	03.7 01.6	04.6 02.0	05.5 02.4	06.4 02.8	07.3 03.3	66	00.9 00.4	01.8 00.8	02.7 01.2	03.7 01.6	04.6 02.0	05.5 02.4	06.4 02.8	07.3 03.3	66
25	00.9 00.4	01.8 00.8	02.7 01.3	03.6 01.7	04.5 02.1	05.4 02.5	06.3 03.0	07.3 03.4	65	00.9 00.4	01.8 00.8	02.7 01.3	03.6 01.7	04.5 02.1	05.4 02.5	06.3 03.0	07.3 03.4	65
26	00.9 00.4	01.8 00.9	02.7 01.3	03.6 01.8	04.5 02.2	05.4 02.6	06.3 03.1	07.2 03.5	64	00.9 00.4	01.8 00.9	02.7 01.3	03.6 01.8	04.5 02.2	05.4 02.6	06.3 03.1	07.2 03.5	64
27	00.9 00.5	01.8 00.9	02.7 01.4	03.6 01.8	04.5 02.3	05.3 02.7	06.2 03.2	07.1 03.6	63	00.9 00.5	01.8 00.9	02.7 01.4	03.6 01.8	04.5 02.3	05.3 02.7	06.2 03.2	07.1 03.6	63
28	00.9 00.5	01.8 00.9	02.6 01.4	03.5 01.9	04.4 02.3	05.3 02.8	06.2 03.3	07.1 03.8	62	00.9 00.5	01.8 00.9	02.6 01.4	03.5 01.9	04.4 02.3	05.3 02.8	06.2 03.3	07.1 03.8	62
29	00.9 00.5	01.7 01.0	02.6 01.5	03.5 01.9	04.4 02.4	05.2 02.9	06.1 03.4	07.0 03.9	61	00.9 00.5	01.7 01.0	02.6 01.5	03.5 01.9	04.4 02.4	05.2 02.9	06.1 03.4	07.0 03.9	61
30	00.9 00.5	01.7 01.0	02.6 01.5	03.5 02.0	04.3 02.5	05.2 03.0	06.1 03.5	06.9 04.0	60	00.9 00.5	01.7 01.0	02.6 01.5	03.5 02.0	04.3 02.5	05.2 03.0	06.1 03.5	06.9 04.0	60
31	00.9 00.5	01.7 01.0	02.6 01.5	03.4 02.1	04.3 02.6	05.1 03.1	06.0 03.6	06.9 04.1	59	00.9 00.5	01.7 01.0	02.6 01.5	03.4 02.1	04.3 02.6	05.1 03.1	06.0 03.6	06.9 04.1	59
32	00.8 00.5	01.7 01.1	02.5 01.6	03.4 02.1	04.2 02.6													

Traverse Table.

(x.)

Distance. 9			10			11			12			13			14			15			16					
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.			
1	09.0 00.4	10.0 00.5	11.0 00.5	12.0 00.6	13.0 00.6	14.0 00.7	15.0 00.7	16.0 00.8	7	08.8 01.8	09.8 02.0	10.8 02.1	11.8 02.3	12.7 02.5	13.7 02.7	14.7 02.9	15.7 03.1	7	08.7 02.2	09.7 02.4	10.7 02.7	11.6 02.9	12.6 03.2	13.6 03.4	14.6 03.6	15.5 03.9
2	09.0 00.9	10.0 01.0	10.9 01.1	11.9 01.2	12.9 01.3	13.9 01.4	14.9 01.5	15.9 01.6	5	08.6 02.6	09.6 02.9	10.5 03.2	11.5 03.5	12.4 03.8	13.4 04.1	14.4 04.4	15.3 04.6	5	08.5 03.0	09.4 03.4	10.4 03.7	11.3 04.0	12.2 04.4	13.2 04.7	14.1 05.1	15.1 05.4
3	08.9 01.3	09.9 01.5	10.9 01.6	11.9 01.8	12.9 01.9	13.8 02.1	14.8 02.2	15.8 02.3	3	08.3 03.4	09.2 03.8	10.2 04.2	11.1 04.6	12.0 05.0	12.9 05.4	13.9 05.7	14.8 06.1	3	08.1 03.8	09.0 04.3	09.9 04.7	10.8 05.1	11.8 05.6	12.7 06.0	13.6 06.4	14.5 06.8
4	08.8 01.8	09.8 02.0	10.8 02.1	11.8 02.3	12.7 02.5	13.7 02.7	14.7 02.9	15.7 03.1	1	07.9 04.2	08.8 04.7	09.7 05.2	10.6 05.7	11.5 06.1	12.3 06.6	13.2 07.1	14.1 07.5	1	07.7 04.6	08.6 05.1	09.4 05.7	10.3 06.2	11.2 06.7	12.0 07.2	12.9 07.7	13.7 08.2
5	08.7 02.2	09.7 02.4	10.7 02.7	11.6 02.9	12.6 03.2	13.6 03.4	14.6 03.6	15.5 03.9	2	07.5 05.0	08.3 05.6	09.1 06.1	10.0 06.7	10.8 07.2	11.6 07.8	12.5 08.3	13.3 08.9	2	07.2 05.4	08.0 06.0	08.8 06.6	09.6 07.1	10.4 07.7	11.2 08.3	12.0 08.9	12.8 09.5
6	08.6 02.6	09.6 02.9	10.5 03.2	11.5 03.5	12.4 03.8	13.4 04.1	14.4 04.4	15.3 04.6	2	07.0 05.7	07.7 06.3	08.5 07.0	09.3 07.6	10.1 08.2	10.8 08.9	11.6 09.5	12.4 10.1	2	06.7 06.0	07.4 06.7	08.2 07.4	08.9 08.1	09.6 08.7	10.4 09.4	11.1 10.1	11.9 10.7
7	08.5 03.0	09.4 03.4	10.4 03.7	11.3 04.0	12.2 04.4	13.2 04.7	14.1 05.1	15.1 05.4	2	06.4 06.4	07.1 07.1	07.8 07.8	08.5 08.5	09.2 09.2	09.9 09.9	10.6 10.6	11.3 11.3	2	06.4 06.4	07.1 07.1	07.8 07.8	08.5 08.5	09.2 09.2	09.9 09.9	10.6 10.6	11.3 11.3
8	08.3 03.4	09.2 03.8	10.2 04.2	11.1 04.6	12.0 05.0	12.9 05.4	13.9 05.7	14.8 06.1	2	09.0 00.2	10.0 00.2	11.0 00.2	12.0 00.2	13.0 00.2	14.0 00.2	15.0 00.3	16.0 00.3	2	09.0 00.2	10.0 00.2	11.0 00.2	12.0 00.2	13.0 00.2	14.0 00.2	15.0 00.3	16.0 00.3
9	08.1 03.8	09.0 04.3	09.9 04.7	10.8 05.1	11.8 05.6	12.7 06.0	13.6 06.4	14.5 06.8	2	09.0 00.3	10.0 00.3	11.0 00.4	12.0 00.4	13.0 00.5	14.0 00.5	15.0 00.5	16.0 00.6	2	09.0 00.3	10.0 00.3	11.0 00.4	12.0 00.4	13.0 00.5	14.0 00.5	15.0 00.5	16.0 00.6
10	07.9 04.2	08.8 04.7	09.7 05.2	10.6 05.7	11.5 06.1	12.3 06.6	13.2 07.1	14.1 07.5	2	09.0 00.5	10.0 00.5	11.0 00.6	12.0 00.6	13.0 00.7	14.0 00.7	15.0 00.8	16.0 00.8	2	09.0 00.5	10.0 00.5	11.0 00.6	12.0 00.6	13.0 00.7	14.0 00.7	15.0 00.8	16.0 00.8
11	07.7 04.6	08.6 05.1	09.4 05.7	10.3 06.2	11.2 06.7	12.0 07.2	12.9 07.7	13.7 08.2	2	09.0 00.6	10.0 00.7	11.0 00.8	12.0 00.8	13.0 00.9	14.0 01.0	15.0 01.0	16.0 01.1	2	09.0 00.6	10.0 00.7	11.0 00.8	12.0 00.8	13.0 00.9	14.0 01.0	15.0 01.0	16.0 01.1
12	07.5 05.0	08.3 05.6	09.1 06.1	10.0 06.7	10.8 07.2	11.6 07.8	12.5 08.3	13.3 08.9	2	09.0 00.8	10.0 00.9	11.0 01.0	12.0 01.0	13.0 01.1	13.9 01.2	14.9 01.3	15.9 01.4	2	09.0 00.8	10.0 00.9	11.0 01.0	12.0 01.0	13.0 01.1	13.9 01.2	14.9 01.3	15.9 01.4
13	07.2 05.4	08.0 06.0	08.8 06.6	09.6 07.1	10.4 07.7	11.2 08.3	12.0 08.9	12.8 09.5	2	09.0 00.9	09.9 01.0	10.9 01.1	11.9 01.3	12.9 01.4	13.9 01.5	14.9 01.6	15.9 01.7	2	09.0 00.9	09.9 01.0	10.9 01.1	11.9 01.3	12.9 01.4	13.9 01.5	14.9 01.6	15.9 01.7
14	07.0 05.7	07.7 06.3	08.5 07.0	09.3 07.6	10.1 08.2	10.8 08.9	11.6 09.5	12.4 10.1	2	08.9 01.1	09.9 01.2	10.9 01.3	11.9 01.5	12.9 01.6	13.9 01.7	14.9 01.8	15.9 01.9	2	08.9 01.1	09.9 01.2	10.9 01.3	11.9 01.5	12.9 01.6	13.9 01.7	14.9 01.8	15.9 01.9
15	06.7 06.0	07.4 06.7	08.2 07.4	08.9 08.1	09.6 08.7	10.4 09.4	11.1 10.1	11.9 10.7	2	08.9 01.3	09.9 01.4	10.9 01.5	11.9 01.7	12.9 01.8	13.9 01.9	14.9 02.1	15.8 02.2	2	08.9 01.3	09.9 01.4	10.9 01.5	11.9 01.7	12.9 01.8	13.9 01.9	14.9 02.1	15.8 02.2
16	06.4 06.4	07.1 07.1	07.8 07.8	08.5 08.5	09.2 09.2	09.9 09.9	10.6 10.6	11.3 11.3	2	08.9 01.4	09.9 01.6	10.9 01.7	11.9 01.9	12.8 02.0	13.8 02.2	14.8 02.3	15.8 02.5	2	08.9 01.4	09.9 01.6	10.9 01.7	11.9 01.9	12.8 02.0	13.8 02.2	14.8 02.3	15.8 02.5
17	09.0 00.2	10.0 00.2	11.0 00.2	12.0 00.2	13.0 00.2	14.0 00.2	15.0 00.3	16.0 00.3	2	08.9 01.6	09.8 01.7	10.8 01.9	11.8 02.1	12.8 02.3	13.8 02.4	14.8 02.6	15.8 02.8	2	08.9 01.6	09.8 01.7	10.8 01.9	11.8 02.1	12.8 02.3	13.8 02.4	14.8 02.6	15.8 02.8
18	09.0 00.3	10.0 00.3	11.0 00.4	12.0 00.4	13.0 00.5	14.0 00.5	15.0 00.5	16.0 00.6	2	08.8 01.7	09.8 01.9	10.8 02.1	11.8 02.3	12.8 02.5	13.7 02.7	14.7 02.9	15.7 03.1	2	08.8 01.7	09.8 01.9	10.8 02.1	11.8 02.3	12.8 02.5	13.7 02.7	14.7 02.9	15.7 03.1
19	09.0 00.5	10.0 00.5	11.0 00.6	12.0 00.6	13.0 00.7	14.0 00.7	15.0 00.8	16.0 00.8	2	08.8 01.9	09.8 02.1	10.8 02.3	11.7 02.5	12.7 02.7	13.7 02.9	14.7 03.1	15.7 03.3	2	08.8 01.9	09.8 02.1	10.8 02.3	11.7 02.5	12.7 02.7	13.7 02.9	14.7 03.1	15.7 03.3
20	09.0 00.6	10.0 00.7	11.0 00.8	12.0 00.8	13.0 00.9	14.0 01.0	15.0 01.0	16.0 01.1	2	08.8 02.0	09.7 02.2	10.7 02.5	11.7 02.7	12.7 02.9	13.6 03.1	14.6 03.4	15.6 03.6	2	08.8 02.0	09.7 02.2	10.7 02.5	11.7 02.7	12.7 02.9	13.6 03.1	14.6 03.4	15.6 03.6
21	09.0 00.8	10.0 00.9	11.0 01.0	12.0 01.0	13.0 01.1	13.9 01.2	14.9 01.3	15.9 01.4	2	08.7 02.2	09.7 02.4	10.7 02.7	11.6 02.9	12.6 03.1	13.6 03.4	14.6 03.6	15.5 03.9	2	08.7 02.2	09.7 02.4	10.7 02.7	11.6 02.9	12.6 03.1	13.6 03.4	14.6 03.6	15.5 03.9
22	09.0 00.9	09.9 01.0	10.9 01.1	11.9 01.3	12.9 01.4	13.9 01.5	14.9 01.6	15.9 01.7	2	08.7 02.3	09.7 02.6	10.6 02.8	11.6 03.1	12.6 03.4	13.5 03.6	14.5 03.9	15.5 04.1	2	08.7 02.3	09.7 02.6	10.6 02.8	11.6 03.1	12.6 03.4	13.5 03.6	14.5 03.9	15.5 04.1
23	08.9 01.1	09.9 01.2	10.9 01.3	11.9 01.5	12.9 01.6	13.9 01.7	14.9 01.8	15.9 01.9	2	08.7 02.5	09.6 02.8	10.6 03.0	11.5 03.3	12.5 03.6	13.5 03.9	14.4 04.1	15.4 04.4	2	08.7 02.5	09.6 02.8	10.6 03.0	11.5 03.3	12.5 03.6	13.5 03.9	14.4 04.1	15.4 04.4
24	08.9 01.3	09.9 01.4	10.9 01.5	11.9 01.7	12.9 01.8	13.9 01.9	14.9 02.1	15.8 02.2	2	08.6 02.6	09.6 02.9	10.5 03.2	11.5 03.5	12.4 03.8	13.4 04.1	14.3 04.4	15.3 04.7	2	08.6 02.6	09.6 02.9	10.5 03.2	11.5 03.5	12.4 03.8	13.4 04.1	14.3 04.4	15.3 04.7
25	08.9 01.4	09.9 01.6	10.9 01.7	11.9 01.9	12.8 02.0	13.8 02.2	14.8 02.3	15.8 02.5	2	08.6 02.8	09.5 03.1	10.5 03.4	11.4 03.7	12.4 04.0	13.3 04.3	14.3 04.6	15.2 04.9	2	08.6 02.8	09.5 03.1	10.5 03.4	11.4 03.7	12.4 04.0	13.3 04.3	14.3 04.6	15.2 04.9
26	08.9 01.6	09.8 01.7	10.8 01.9	11.8 02.1	12.8 02.3	13.8 02.4	14.8 02.6	15.8 02.8	2	08.5 02.9	09.5 03.3	10.4 03.6	11.3 03.9	12.3 04.2	13.2 04.6	14.2 04.9	15.1 05.2	2	08.5 02.9	09.5 03.3	10.4 03.6	11.3 03.9	12.3 04.2	13.2 04.6	14.2 04.9	15.1 05.2
27	08.8 01.7	09.8 01.9	10.8 02.1	11.8 02.3	12.8 02.5	13.7 02.7	14.7 02.9	15.7 03.1	2	08.5 03.1	09.4 03.4	10.3 03.8	11.3 04.1	12.2 04.4	13.2 04.8	14.1 05.1	15.0 05.5	2	08.5 03.1	09.4 03.4	10.3 03.8	11.3 04.1	12.2 04.4	13.2 04.8	14.1 05.1	15.0 05.5
28	08.8 01.9	09.8 02.1	10.8 02.3	11.7 02.5	12.7 02.7	13.7 02.9	14.7 03.1	15.7 03.3	2	08.4 03.2	09.3 03.6	10.3 03.9	11.2 04.3	12.1 04.7	13.1 05.0	14.0 05.4	14.9 05.7	2	08.4 03.2	09.3 03.6	10.3 03.9	11.2 04.3	12.1 04.7	13.1 05.0	14.0 05.4	14.9 05.7
29	08.8 02.0	09.7 02.2	10.7 02.5	11.7 02.7	12.7 02.9	13.6 03.1	14.6 03.4	15.6 03.6	2	08.3 03.4	09.3 03.7	10.2 04.1	11.1 04.5	12.1 04.9	13.0 05.2	13.9 05.6	14.8 06.0	2	08.3 03.4	09.3 03.7	10.2 04.1	11.1 04.5	12.1 04.9	13.0 05.2	13.9 05.6	14.8 06.0
30	08.7 02.2	09.7 02.4	10.7 02.7	11.6 02.9	12.6 03.1	13.6 03.4	14.6 03.6	15.5 03.9	2	08.3 03.5	09.2 03.9	10.1 04.3	11.0 04.7	12.0 05.1	12.9 05.5	13.8 05.9	14.7 06.3	2	08.3 03.5	09.2 03.9	10.1 04.3	11.0 04.7	12.0 05.1	12.9 05.5	13.8 05.9	14.7 06.3
31	08.7 02.3	09.7 02.6	10.6 02.8	11.6 03.1	12.6 03.4	13.5 03.6	14.5 03.9	15.5 04.1	2	08.2 03.7	09.1 04.															

Traverse Table.

(x.)

Distance. 17			18			19			20			21			22			23			24		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.		
1	17.0 00.8		18.0 00.9		19.0 00.9		20.0 01.0		21.0 01.0		22.0 01.1		23.0 01.1		24.0 01.2						73		
	16.9 01.7		17.9 01.8		18.9 01.9		19.9 02.0		20.9 02.1		21.9 02.2		22.9 02.3		23.9 02.4						74		
	16.8 02.5		17.8 02.6		18.8 02.8		19.8 02.9		20.8 03.1		21.8 03.2		22.7 03.4		23.7 03.5						75		
	16.7 03.3		17.7 03.5		18.6 03.7		19.6 03.9		20.6 04.1		21.6 04.3		22.6 04.5		23.5 04.7						76		
2	16.5 04.1		17.5 04.4		18.4 04.6		19.4 04.9		20.4 05.1		21.3 05.3		22.3 05.6		23.3 05.8						77		
	16.3 04.9		17.2 05.2		18.2 05.5		19.1 05.8		20.1 06.1		21.1 06.4		22.0 06.7		23.0 07.0						78		
	16.0 05.7		17.0 06.1		17.9 06.4		18.8 06.7		19.8 07.1		20.7 07.4		21.7 07.7		22.6 08.1						79		
3	15.7 06.5		16.6 06.9		17.6 07.3		18.5 07.7		19.4 08.0		20.3 08.4		21.3 08.8		22.2 09.2						80		
	15.4 07.3		16.3 07.7		17.2 08.1		18.1 08.6		19.0 09.0		19.9 09.4		20.8 09.8		21.7 10.3						81		
	15.0 08.0		15.9 08.5		16.8 09.0		17.6 09.4		18.5 09.9		19.4 10.4		20.3 10.8		21.2 11.3						82		
	14.6 08.7		15.4 09.3		16.3 09.8		17.2 10.3		18.0 10.8		18.9 11.3		19.7 11.8		20.6 12.3						83		
4	14.1 09.4		15.0 10.0		15.8 10.6		16.6 11.1		17.5 11.7		18.3 12.2		19.1 12.8		20.0 13.3						84		
	13.7 10.1		14.5 10.7		15.3 11.3		16.1 11.9		16.9 12.5		17.7 13.1		18.5 13.7		19.3 14.3						85		
	13.1 10.8		13.9 11.4		14.7 12.0		15.5 12.7		16.2 13.3		17.0 14.0		17.8 14.6		18.5 15.2						86		
	12.6 11.4		13.3 12.1		14.1 12.8		14.8 13.4		15.6 14.1		16.3 14.8		17.0 15.4		17.8 16.1						87		
5	12.0 12.0		12.7 12.7		13.4 13.4		14.1 14.1		14.8 14.8		15.6 15.6		16.3 16.3		17.0 17.0						88		
1	17.0 00.3		18.0 00.3		19.0 00.3		20.0 00.3		21.0 00.4		22.0 00.4		23.0 00.4		24.0 00.4						89°		
2	17.0 00.6		18.0 00.6		19.0 00.7		20.0 00.7		21.0 00.7		22.0 00.8		23.0 00.8		24.0 00.8						88		
3	17.0 00.9		18.0 00.9		19.0 01.0		20.0 01.0		21.0 01.1		22.0 01.2		23.0 01.2		24.0 01.3						87		
4	17.0 01.2		18.0 01.3		19.0 01.3		20.0 01.4		20.9 01.5		21.9 01.5		22.9 01.6		23.9 01.7						86		
5	16.9 01.5		17.9 01.6		18.9 01.7		19.9 01.7		20.9 01.8		21.9 01.9		22.9 02.0		23.9 02.1						85		
6	16.9 01.8		17.9 01.9		18.9 02.0		19.9 02.1		20.9 02.2		21.9 02.3		22.9 02.4		23.9 02.5						84		
7	16.9 02.1		17.9 02.2		18.9 02.3		19.9 02.4		20.8 02.6		21.8 02.7		22.8 02.8		23.8 02.9						83		
8	16.8 02.4		17.8 02.5		18.8 02.6		19.8 02.8		20.8 02.9		21.8 03.1		22.8 03.2		23.8 03.3						82		
9	16.8 02.7		17.8 02.8		18.8 03.0		19.8 03.1		20.7 03.3		21.7 03.4		22.7 03.6		23.7 03.8						81		
10	16.7 03.0		17.7 03.1		18.7 03.3		19.7 03.5		20.7 03.6		21.7 03.8		22.7 04.0		23.6 04.2						80		
11	16.7 03.2		17.7 03.4		18.7 03.6		19.6 03.8		20.6 04.0		21.6 04.2		22.6 04.4		23.6 04.6						79		
12	16.6 03.5		17.6 03.7		18.6 04.0		19.6 04.2		20.5 04.4		21.5 04.6		22.5 04.8		23.5 05.0						78		
13	16.6 03.8		17.5 04.0		18.5 04.3		19.5 04.5		20.5 04.7		21.4 04.9		22.4 05.2		23.4 05.4						77		
14	16.5 04.1		17.5 04.4		18.4 04.6		19.4 04.8		20.4 05.1		21.3 05.3		22.3 05.6		23.3 05.8						76		
15	16.4 04.4		17.4 04.7		18.4 04.9		19.3 05.2		20.3 05.4		21.3 05.7		22.2 06.0		23.2 06.2						75		
16	16.3 04.7		17.3 05.0		18.3 05.2		19.2 05.5		20.2 05.8		21.1 06.1		22.1 06.3		23.1 06.6						74		
17	16.3 05.0		17.2 05.3		18.2 05.6		19.1 05.8		20.1 06.1		21.0 06.4		22.0 06.7		23.0 07.0						73		
18	16.2 05.3		17.1 05.6		18.1 05.9		19.0 06.2		20.0 06.5		20.9 06.8		21.9 07.1		22.8 07.4						72		
19	16.1 05.5		17.0 05.9		18.0 06.2		18.9 06.5		19.9 06.8		20.8 07.2		21.7 07.5		22.7 07.8						71		
20	16.0 05.8		16.9 06.2		17.9 06.5		18.8 06.8		19.7 07.2		20.7 07.5		21.6 07.9		22.6 08.2						70		
21	15.9 06.1		16.8 06.5		17.7 06.8		18.7 07.2		19.6 07.5		20.5 07.9		21.5 08.2		22.4 08.6						69		
22	15.8 06.4		16.7 06.7		17.6 07.1		18.5 07.5		19.5 07.9		20.4 08.2		21.3 08.6		22.3 09.0						68		
23	15.6 06.6		16.6 07.0		17.5 07.4		18.4 07.8		19.3 08.2		20.3 08.6		21.2 09.0		22.1 09.4						67		
24	15.5 06.9		16.4 07.3		17.4 07.7		18.3 08.1		19.2 08.5		20.1 08.9		21.0 09.4		21.9 09.8						66		
25	15.4 07.2		16.3 07.6		17.2 08.0		18.1 08.5		19.0 08.9		19.9 09.3		20.8 09.7		21.8 10.1						65		
26	15.3 07.5		16.2 07.9		17.1 08.3		18.0 08.8		18.9 09.2		19.8 09.6		20.7 10.1		21.6 10.5						64		
27	15.1 07.7		16.0 08.2		16.9 08.6		17.8 09.1		18.7 09.5		19.6 10.0		20.5 10.4		21.4 10.9						63		
28	15.0 08.0		15.9 08.5		16.8 08.9		17.7 09.4		18.5 09.9		19.4 10.3		20.3 10.8		21.2 11.3						62		
29	14.9 08.2		15.7 08.7		16.6 09.2		17.5 09.7		18.4 10.2		19.2 10.7		20.1 11.2		21.0 11.6						61		
30	14.7 08.5		15.6 09.0		16.5 09.5		17.3 10.0		18.2 10.5		19.1 11.0		19.9 11.5		20.8 12.0						60		
31	14.6 08.8		15.4 09.3		16.3 09.8		17.1 10.3		18.0 10.8		18.9 11.3		19.7 11.8		20.6 12.4						59		
32	14.4 09.0		15.3 09.5		16.1 10.1		17.0 10.6		17.8 11.1		18.7 11.7		19.5 12.2		20.4 12.7						58		
33	14.3 09.3		15.1 09.8		15.9 10.3		16.8 10.9		17.6 11.4		18.5 12.0		19.3 12.5		20.1 13.1						57		
34	14.1 09.5		14.9 10.1		15.8 10.6		16.6 11.2		17.4 11.7		18.2 12.3		19.1 12.9		19.9 13.4						56		
35	13.9 09.8		14.7 10.3		15.6 10.9		16.4 11.5		17.2 12.0		18.0 12.6		18.8 13.2		19.7 13.8						55		
36	13.8 10.0		14.6 10.6		15.4 11.2		16.2 11.8		17.0 12.3		17.8 12.9		18.6 13.5		19.4 14.1						54		
37	13.6 10.2		14.4 10.8		15.2 11.4		16.0 12.0		16.8 12.6		17.6 13.2		18.4 13.8		19.2 14.4						53		
38	13.4 10.5		14.2 11.1		15.0 11.7		15.8 12.3		16.5 12.9		17.3 13.5		18.1 14.2		18.9 14.8						52		
39	13.2 10.7		14.0 11.3		14.8 12.0		15.5 12.6		16.3 13.2		17.1 13.8		17.9 14.5		18.7 15.1						51		
40	13.0 10.9		13.8 11.6		14.6 12.2		15.3 12.9		16.1 13.5		16.9 14.1		17.6 14.8		18.4 15.4						50		
41	12.8 11.2		13.6 11.8		14.3 12.5		15.1 13.1		15.8 13.8		16.6 14.4		17.4 15.1		18.1 15.7						49		
42	12.6 11.4		13.4 12.0		14.1 12.7		14.9 13.4		15.6 14.1		16.3 14.7		17.1 15.4		17.8 16.1						48		
43	12.4 11.6		13.2 12.3		13.9 13.0		14.6 13.6		15.4 14.3		16.1 15.0		16.8 15.7		17.6 16.4						47		
44	12.2 11.8		12.9 12.5		13.7 13.2		14.4 13.9		15.1 14.6		15.8 15.3		16.5 16.0		17.3 16.7						46		
45	12.0 12.0		12.7 12.7		13.4 13.4		14.1 14.1		14.8 14.8		15.6 15.6		16.3 16.3		17.0 17.0						45		
Crs.																							

Traverse Table

(x.)

Distance. 25		26		27		28		29		30		31		32		Crse.		
Crse.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crse.			
1	25.0 01.2	26.0 01.3	27.0 01.3	28.0 01.4	29.0 01.4	30.0 01.5	31.0 01.5	32.0 01.6	7	25.0 01.2	26.0 01.3	27.0 01.3	28.0 01.4	29.0 01.4	30.0 01.5	31.0 01.5	32.0 01.6	7
2	24.9 02.4	25.9 02.5	26.9 02.6	27.9 02.7	28.9 02.8	29.9 02.9	30.9 03.0	31.8 03.1	3	24.9 02.4	25.9 02.5	26.9 02.6	27.9 02.7	28.9 02.8	29.9 02.9	30.9 03.0	31.8 03.1	3
3	24.7 03.7	25.7 03.8	26.7 04.0	27.7 04.1	28.7 04.3	29.7 04.4	30.7 04.5	31.7 04.7	4	24.7 03.7	25.7 03.8	26.7 04.0	27.7 04.1	28.7 04.3	29.7 04.4	30.7 04.5	31.7 04.7	4
4	24.5 04.9	25.5 05.1	26.5 05.3	27.5 05.5	28.4 05.7	29.4 05.9	30.4 06.0	31.4 06.2	5	24.5 04.9	25.5 05.1	26.5 05.3	27.5 05.5	28.4 05.7	29.4 05.9	30.4 06.0	31.4 06.2	5
5	24.3 06.1	25.2 06.3	26.2 06.6	27.2 06.8	28.1 07.0	29.1 07.3	30.1 07.5	31.0 07.8	6	24.3 06.1	25.2 06.3	26.2 06.6	27.2 06.8	28.1 07.0	29.1 07.3	30.1 07.5	31.0 07.8	6
6	23.9 07.3	24.9 07.5	25.8 07.8	26.8 08.1	27.8 08.4	28.7 08.7	29.7 09.0	30.6 09.3	7	23.9 07.3	24.9 07.5	25.8 07.8	26.8 08.1	27.8 08.4	28.7 08.7	29.7 09.0	30.6 09.3	7
7	23.5 08.4	24.5 08.8	25.4 09.1	26.4 09.4	27.3 09.8	28.2 10.1	29.2 10.4	30.1 10.8	8	23.5 08.4	24.5 08.8	25.4 09.1	26.4 09.4	27.3 09.8	28.2 10.1	29.2 10.4	30.1 10.8	8
8	23.1 09.6	24.0 10.0	24.9 10.3	25.9 10.7	26.8 11.1	27.7 11.5	28.6 11.9	29.6 12.2	9	23.1 09.6	24.0 10.0	24.9 10.3	25.9 10.7	26.8 11.1	27.7 11.5	28.6 11.9	29.6 12.2	9
9	22.6 10.7	23.5 11.1	24.4 11.5	25.3 12.0	26.2 12.4	27.1 12.8	28.0 13.3	28.9 13.7	10	22.6 10.7	23.5 11.1	24.4 11.5	25.3 12.0	26.2 12.4	27.1 12.8	28.0 13.3	28.9 13.7	10
10	22.1 11.8	22.9 12.3	23.8 12.7	24.7 13.2	25.6 13.7	26.5 14.1	27.3 14.6	28.2 15.1	11	22.1 11.8	22.9 12.3	23.8 12.7	24.7 13.2	25.6 13.7	26.5 14.1	27.3 14.6	28.2 15.1	11
11	21.4 12.9	22.3 13.4	23.2 13.9	24.0 14.4	24.9 14.9	25.7 15.4	26.6 15.9	27.4 16.4	12	21.4 12.9	22.3 13.4	23.2 13.9	24.0 14.4	24.9 14.9	25.7 15.4	26.6 15.9	27.4 16.4	12
12	20.8 13.9	21.6 14.4	22.4 15.0	23.3 15.6	24.1 16.1	24.9 16.7	25.8 17.2	26.6 17.8	13	20.8 13.9	21.6 14.4	22.4 15.0	23.3 15.6	24.1 16.1	24.9 16.7	25.8 17.2	26.6 17.8	13
13	20.1 14.9	20.9 15.5	21.7 16.1	22.5 16.7	23.3 17.3	24.1 17.9	24.9 18.5	25.7 19.1	14	20.1 14.9	20.9 15.5	21.7 16.1	22.5 16.7	23.3 17.3	24.1 17.9	24.9 18.5	25.7 19.1	14
14	19.3 15.9	20.1 16.5	20.9 17.1	21.6 17.8	22.4 18.4	23.2 19.0	24.0 19.7	24.7 20.3	15	19.3 15.9	20.1 16.5	20.9 17.1	21.6 17.8	22.4 18.4	23.2 19.0	24.0 19.7	24.7 20.3	15
15	18.5 16.8	19.3 17.5	20.0 18.1	20.7 18.8	21.5 19.5	22.2 20.1	23.0 20.8	23.7 21.5	16	18.5 16.8	19.3 17.5	20.0 18.1	20.7 18.8	21.5 19.5	22.2 20.1	23.0 20.8	23.7 21.5	16
16	17.7 17.7	18.4 18.4	19.1 19.1	19.8 19.8	20.5 20.5	21.2 21.2	21.9 21.9	22.6 22.6	17	17.7 17.7	18.4 18.4	19.1 19.1	19.8 19.8	20.5 20.5	21.2 21.2	21.9 21.9	22.6 22.6	17
17	25.0 00.4	26.0 00.5	27.0 00.5	28.0 00.5	29.0 00.5	30.0 00.5	31.0 00.5	32.0 00.6	18	25.0 00.4	26.0 00.5	27.0 00.5	28.0 00.5	29.0 00.5	30.0 00.5	31.0 00.5	32.0 00.6	18
18	25.0 00.9	26.0 00.9	27.0 00.9	28.0 01.0	29.0 01.0	30.0 01.0	31.0 01.1	32.0 01.1	19	25.0 00.9	26.0 00.9	27.0 00.9	28.0 01.0	29.0 01.0	30.0 01.0	31.0 01.1	32.0 01.1	19
19	25.0 01.3	26.0 01.4	27.0 01.4	28.0 01.5	29.0 01.5	30.0 01.6	31.0 01.6	32.0 01.7	20	25.0 01.3	26.0 01.4	27.0 01.4	28.0 01.5	29.0 01.5	30.0 01.6	31.0 01.6	32.0 01.7	20
20	24.9 01.7	25.9 01.8	26.9 01.9	27.9 02.0	28.9 02.0	29.9 02.1	30.9 02.2	31.9 02.2	21	24.9 01.7	25.9 01.8	26.9 01.9	27.9 02.0	28.9 02.0	29.9 02.1	30.9 02.2	31.9 02.2	21
21	24.9 02.2	25.9 02.3	26.9 02.4	27.9 02.4	28.9 02.5	29.9 02.6	30.9 02.7	31.9 02.8	22	24.9 02.2	25.9 02.3	26.9 02.4	27.9 02.4	28.9 02.5	29.9 02.6	30.9 02.7	31.9 02.8	22
22	24.9 02.6	25.9 02.7	26.9 02.8	27.8 02.9	28.8 03.0	29.8 03.1	30.8 03.2	31.8 03.3	23	24.9 02.6	25.9 02.7	26.9 02.8	27.8 02.9	28.8 03.0	29.8 03.1	30.8 03.2	31.8 03.3	23
23	24.8 03.0	25.8 03.2	26.8 03.3	27.8 03.4	28.8 03.5	29.8 03.7	30.8 03.8	31.8 03.9	24	24.8 03.0	25.8 03.2	26.8 03.3	27.8 03.4	28.8 03.5	29.8 03.7	30.8 03.8	31.8 03.9	24
24	24.8 03.5	25.7 03.6	26.7 03.8	27.7 03.9	28.7 04.0	29.7 04.2	30.7 04.3	31.7 04.5	25	24.8 03.5	25.7 03.6	26.7 03.8	27.7 03.9	28.7 04.0	29.7 04.2	30.7 04.3	31.7 04.5	25
25	24.7 03.9	25.7 04.1	26.7 04.2	27.7 04.4	28.6 04.5	29.6 04.7	30.6 04.8	31.6 05.0	26	24.7 03.9	25.7 04.1	26.7 04.2	27.7 04.4	28.6 04.5	29.6 04.7	30.6 04.8	31.6 05.0	26
26	24.6 04.3	25.6 04.5	26.6 04.7	27.6 04.9	28.6 05.0	29.5 05.2	30.5 05.4	31.5 05.6	27	24.6 04.3	25.6 04.5	26.6 04.7	27.6 04.9	28.6 05.0	29.5 05.2	30.5 05.4	31.5 05.6	27
27	24.5 04.8	25.5 05.0	26.5 05.2	27.5 05.3	28.5 05.5	29.4 05.7	30.4 05.9	31.4 06.1	28	24.5 04.8	25.5 05.0	26.5 05.2	27.5 05.3	28.5 05.5	29.4 05.7	30.4 05.9	31.4 06.1	28
28	24.5 05.2	25.4 05.4	26.4 05.6	27.4 05.8	28.4 06.0	29.3 06.2	30.3 06.4	31.3 06.7	29	24.5 05.2	25.4 05.4	26.4 05.6	27.4 05.8	28.4 06.0	29.3 06.2	30.3 06.4	31.3 06.7	29
29	24.4 05.6	25.3 05.8	26.3 06.1	27.3 06.3	28.3 06.5	29.2 06.7	30.2 07.0	31.2 07.2	30	24.4 05.6	25.3 05.8	26.3 06.1	27.3 06.3	28.3 06.5	29.2 06.7	30.2 07.0	31.2 07.2	30
30	24.3 06.0	25.2 06.3	26.2 06.5	27.2 06.8	28.1 07.0	29.1 07.3	30.1 07.5	31.0 07.7	31	24.3 06.0	25.2 06.3	26.2 06.5	27.2 06.8	28.1 07.0	29.1 07.3	30.1 07.5	31.0 07.7	31
31	24.1 06.5	25.1 06.7	26.1 07.0	27.0 07.2	28.0 07.5	29.0 07.8	29.9 08.0	30.9 08.3	32	24.1 06.5	25.1 06.7	26.1 07.0	27.0 07.2	28.0 07.5	29.0 07.8	29.9 08.0	30.9 08.3	32
32	24.0 06.9	25.0 07.2	26.0 07.4	26.9 07.7	27.9 08.0	28.8 08.3	29.8 08.5	30.8 08.8	33	24.0 06.9	25.0 07.2	26.0 07.4	26.9 07.7	27.9 08.0	28.8 08.3	29.8 08.5	30.8 08.8	33
33	23.9 07.3	24.9 07.6	25.8 07.9	26.8 08.2	27.7 08.5	28.7 08.8	29.6 09.1	30.6 09.4	34	23.9 07.3	24.9 07.6	25.8 07.9	26.8 08.2	27.7 08.5	28.7 08.8	29.6 09.1	30.6 09.4	34
34	23.8 07.7	24.7 08.0	25.7 08.3	26.6 08.7	27.6 09.0	28.5 09.3	29.5 09.6	30.4 09.9	35	23.8 07.7	24.7 08.0	25.7 08.3	26.6 08.7	27.6 09.0	28.5 09.3	29.5 09.6	30.4 09.9	35
35	23.6 08.1	24.6 08.5	25.5 08.8	26.5 09.1	27.4 09.4	28.4 09.8	29.3 10.1	30.3 10.4	36	23.6 08.1	24.6 08.5	25.5 08.8	26.5 09.1	27.4 09.4	28.4 09.8	29.3 10.1	30.3 10.4	36
36	23.5 08.6	24.4 08.9	25.4 09.2	26.3 09.6	27.3 09.9	28.2 10.3	29.1 10.6	30.1 10.9	37	23.5 08.6	24.4 08.9	25.4 09.2	26.3 09.6	27.3 09.9	28.2 10.3	29.1 10.6	30.1 10.9	37
37	23.3 09.0	24.3 09.3	25.2 09.7	26.1 10.0	27.1 10.4	28.0 10.8	28.9 11.1	29.9 11.5	38	23.3 09.0	24.3 09.3	25.2 09.7	26.1 10.0	27.1 10.4	28.0 10.8	28.9 11.1	29.9 11.5	38
38	23.2 09.4	24.1 09.7	25.0 10.1	26.0 10.5	26.9 10.9	27.8 11.2	28.7 11.6	29.7 12.0	39	23.2 09.4	24.1 09.7	25.0 10.1	26.0 10.5	26.9 10.9	27.8 11.2	28.7 11.6	29.7 12.0	39
39	23.0 09.8	23.9 10.2	24.9 10.5	25.8 10.9	26.7 11.3	27.6 11.7	28.5 12.1	29.5 12.5	40	23.0 09.8	23.9 10.2	24.9 10.5	25.8 10.9	26.7 11.3	27.6 11.7	28.5 12.1	29.5 12.5	40
40	22.8 10.2	23.8 10.6	24.7 11.0	25.6 11.4	26.5 11.8	27.4 12.2	28.3 12.6	29.2 13.0	41	22.8 10.2	23.8 10.6	24.7 11.0	25.6 11.4	26.5 11.8	27.4 12.2	28.3 12.6	29.2 13.0	41
41	22.7 10.6	23.6 11.0	24.5 11.4	25.4 11.8	26.3 12.3	27.2 12.7	28.1 13.1	29.0 13.5	42	22.7 10.6	23.6 11.0	24.5 11.4	25.4 11.8	26.3 12.3	27.2 12.7	28.1 13.1	29.0 13.5	42
42	22.5 11.0	23.4 11.4	24.3 11.8	25.2 12.3	26.1 12.7	27.0 13.2	27.9 13.6	28.8 14.0	43	22.5 11.0	23.4 11.4	24.3 11.8	25.2 12.3	26.1 12.7	27.0 13.2	27.9 13.6	28.8 14.0	43
43	22.3 11.3	23.2 11.8	24.1 12.3	24.9 12.7	25.8 13.2	26.7 13.6	27.6 14.1	28.5 14.5	44	22.3 11.3	23.2 11.8	24.1 12.3	24.9 12.7	25.8 13.2	26.7 13.6	27.6 14.1	28.5 14.5	44
44	22.1 11.7	23.0 12.2	23.8 12.7	24.7 13.1	25.6 13.6	26.5 14.1	27.4 14.6	28.3 15.0	45	22.1 11.7	23.0 12.2	23.8 12.7	24.7 13.1	25.6 13.6	26.5 14.1	27.4 14.6	28.3 15.0	45
45	21.9 12.1	22.7 12.6	23.6 13.1	24.5 13.6	25.4 14.1	26.2 14.5	27.1 15.0	28.0 15.5	46	21.9 12.1	22.7 12.6	23.6 13.1	24.5 13.6	25.4 14.1	26.2 14.5	27.1 15.0	28.0 15.5	46
46	21.7 12.5	22.5 13.0	23.4 13.5	24.2 14.0	25.1 14.5	26.0 15.0	26.8 15.5	27.7 16.0	47	21.7 12.5	22.5 13.0	23.4 13.5	24.2 14.0	25.1 14.5	26.0 15.0	26.8 15.5	27.7 16.0	47
47	21.4 12.9	22.3 13.4	23.1 13.9	24.0 14.4	24.9 14.9	25.7 15.5	26.6 16.0	27.4 16.5	48	21.4 12.9	22.3 13.4	23.1 13.9	24.0 14.4	24.9 14.9	25.7 15.5	26.6 16.0	27.4 16.5	48
48	21.2 13.2	22.0 13.8	22.9 14.3	23.7 14.8	24.6 15.4	25.4												

Traverse Table.

(x.)

Distance. 33			34			35			36			37			38			39			40		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.		
1	33.0 01.6		34.0 01.7		35.0 01.7		36.0 01.8		37.0 01.8		38.0 01.9		39.0 01.9		40.0 02.0						7		
	32.8 03.2		33.8 03.3		34.8 03.4		35.8 03.5		36.8 03.6		37.8 03.7		38.8 03.8		39.8 03.9						7		
	32.6 04.8		33.6 05.0		34.6 05.1		35.6 05.3		36.6 05.4		37.6 05.6		38.6 05.7		39.6 05.9						7		
	32.4 06.4		33.3 06.6		34.3 06.8		35.3 07.0		36.3 07.2		37.3 07.4		38.2 07.6		39.2 07.8						7		
2	32.0 08.0		33.0 08.3		34.0 08.5		34.9 08.7		35.9 09.0		36.9 09.2		37.8 09.5		38.8 09.7						6		
	31.6 09.6		32.5 09.9		33.5 10.2		34.5 10.4		35.4 10.7		36.4 11.0		37.3 11.3		38.3 11.6						6		
	31.1 11.1		32.0 11.5		33.0 11.8		33.9 12.1		34.8 12.5		35.8 12.8		36.7 13.1		37.7 13.5						6		
	30.5 12.6		31.4 13.0		32.3 13.4		33.3 13.8		34.2 14.2		35.1 14.5		36.0 14.9		37.0 15.3						6		
3	29.8 14.1		30.7 14.5		31.6 15.0		32.5 15.4		33.4 15.8		34.4 16.2		35.3 16.7		36.2 17.1						5		
	29.1 15.6		30.0 16.0		30.9 16.5		31.8 17.0		32.6 17.4		33.5 17.9		34.4 18.4		35.3 18.9						5		
	28.3 17.0		29.2 17.5		30.0 18.0		30.9 18.5		31.7 19.0		32.6 19.5		33.5 20.0		34.3 20.6						5		
	27.4 18.3		28.3 18.9		29.1 19.4		29.9 20.0		30.8 20.6		31.6 21.1		32.4 21.7		33.3 22.2						5		
4	26.5 19.7		27.3 20.3		28.1 20.9		28.9 21.4		29.7 22.0		30.5 22.6		31.3 23.2		32.1 23.8						4		
	25.5 20.9		26.3 21.6		27.1 22.2		27.8 22.8		28.6 23.5		29.4 24.1		30.1 24.7		30.9 25.4						4		
	24.4 22.2		25.2 22.8		25.9 23.5		26.7 24.2		27.4 24.8		28.2 25.5		28.9 26.2		29.6 26.9						4		
	23.3 23.3		24.0 24.0		24.7 24.7		25.5 25.5		26.2 26.2		26.9 26.9		27.6 27.6		28.3 28.3						4		
1°	33.0 00.6		34.0 00.6		35.0 00.6		36.0 00.6		37.0 00.6		38.0 00.7		39.0 00.7		40.0 00.7						89°		
2	33.0 01.2		34.0 01.2		35.0 01.2		36.0 01.3		37.0 01.3		38.0 01.3		39.0 01.4		40.0 01.4						88		
3	33.0 01.7		34.0 01.8		35.0 01.8		36.0 01.9		36.9 01.9		37.9 02.0		38.9 02.0		39.9 02.1						87		
4	32.9 02.3		33.9 02.4		34.9 02.4		35.9 02.5		36.9 02.6		37.9 02.7		38.9 02.7		39.9 02.8						86		
5	32.9 02.9		33.9 03.0		34.9 03.1		35.9 03.1		36.9 03.2		37.9 03.3		38.9 03.4		39.8 03.5						85		
6	32.8 03.4		33.8 03.6		34.8 03.7		35.8 03.8		36.8 03.9		37.8 04.0		38.8 04.1		39.8 04.2						84		
7	32.8 04.0		33.7 04.1		34.7 04.3		35.7 04.4		36.7 04.5		37.7 04.6		38.7 04.8		39.7 04.9						83		
8	32.7 04.6		33.7 04.7		34.7 04.9		35.6 05.0		36.6 05.1		37.6 05.3		38.6 05.4		39.6 05.6						82		
9	32.6 05.2		33.6 05.3		34.6 05.5		35.6 05.6		36.5 05.8		37.5 05.9		38.5 06.1		39.5 06.3						81		
10	32.5 05.7		33.5 05.9		34.5 06.1		35.5 06.3		36.4 06.4		37.4 06.6		38.4 06.8		39.4 06.9						80		
11	32.4 06.3		33.4 06.5		34.4 06.7		35.3 06.9		36.3 07.1		37.3 07.3		38.3 07.4		39.3 07.6						79		
12	32.3 06.9		33.3 07.1		34.2 07.3		35.2 07.5		36.2 07.7		37.2 07.9		38.1 08.1		39.1 08.3						78		
13	32.2 07.4		33.1 07.6		34.1 07.9		35.1 08.1		36.1 08.3		37.0 08.5		38.0 08.8		39.0 09.0						77		
14	32.0 08.0		33.0 08.2		34.0 08.5		34.9 08.7		35.9 09.0		36.9 09.2		37.8 09.4		38.8 09.7						76		
15	31.9 08.5		32.8 08.8		33.8 09.1		34.8 09.3		35.7 09.6		36.7 09.8		37.7 10.1		38.6 10.4						75		
16	31.7 09.1		32.7 09.4		33.6 09.6		34.6 09.9		35.6 10.2		36.5 10.5		37.5 10.7		38.5 11.0						74		
17	31.6 09.6		32.5 09.9		33.5 10.2		34.4 10.5		35.4 10.8		36.3 11.1		37.3 11.4		38.3 11.7						73		
18	31.4 10.2		32.3 10.5		33.3 10.8		34.2 11.1		35.2 11.4		36.1 11.7		37.1 12.1		38.0 12.4						72		
19	31.2 10.7		32.2 11.1		33.1 11.4		34.0 11.7		35.0 12.0		35.9 12.4		36.9 12.7		37.8 13.0						71		
20	31.0 11.3		31.9 11.6		32.9 12.0		33.8 12.3		34.8 12.7		35.7 13.0		36.6 13.3		37.6 13.7						70		
21	30.8 11.8		31.7 12.2		32.7 12.5		33.6 12.9		34.5 13.3		35.5 13.6		36.4 14.0		37.3 14.3						69		
22	30.6 12.4		31.5 12.7		32.5 13.1		33.4 13.5		34.3 13.9		35.2 14.2		36.2 14.6		37.1 15.0						68		
23	30.4 12.9		31.3 13.3		32.2 13.7		33.1 14.1		34.1 14.5		35.0 14.8		35.9 15.2		36.8 15.6						67		
24	30.1 13.4		31.1 13.8		32.0 14.2		32.9 14.6		33.8 15.0		34.7 15.5		35.6 15.9		36.5 16.3						66		
25	29.9 13.9		30.8 14.4		31.7 14.8		32.6 15.2		33.5 15.6		34.4 16.1		35.3 16.5		36.3 16.9						65		
26	29.7 14.5		30.6 14.9		31.5 15.3		32.4 15.8		33.3 16.2		34.2 16.7		35.1 17.1		36.0 17.5						64		
27	29.4 15.0		30.3 15.4		31.2 15.9		32.1 16.3		33.0 16.8		33.9 17.3		34.7 17.7		35.6 18.2						63		
28	29.1 15.5		30.0 16.0		30.9 16.4		31.8 16.9		32.7 17.4		33.6 17.8		34.4 18.3		35.3 18.8						62		
29	28.9 16.0		29.7 16.5		30.6 17.0		31.5 17.5		32.4 17.9		33.2 18.4		34.1 18.9		35.0 19.4						61		
30	28.6 16.5		29.4 17.0		30.3 17.5		31.2 18.0		32.0 18.5		32.9 19.0		33.8 19.5		34.6 20.0						60		
31	28.3 17.0		29.1 17.5		30.0 18.0		30.9 18.5		31.7 19.1		32.6 19.6		33.4 20.1		34.3 20.6						59		
32	28.0 17.5		28.8 18.0		29.7 18.5		30.5 19.1		31.4 19.6		32.2 20.1		33.1 20.7		33.9 21.2						58		
33	27.7 18.0		28.5 18.5		29.4 19.1		30.2 19.6		31.0 20.2		31.9 20.7		32.7 21.2		33.5 21.8						57		
34	27.4 18.5		28.2 19.0		29.0 19.6		29.8 20.1		30.7 20.7		31.5 21.2		32.3 21.8		33.2 22.4						56		
35	27.0 18.9		27.9 19.5		28.7 20.1		29.5 20.6		30.3 21.2		31.1 21.8		31.9 22.4		32.8 22.9						55		
36	26.7 19.4		27.5 20.0		28.3 20.6		29.1 21.2		29.9 21.7		30.7 22.3		31.6 22.9		32.4 23.5						54		
37	26.4 19.9		27.2 20.5		28.0 21.1		28.8 21.7		29.5 22.3		30.3 22.9		31.1 23.5		31.9 24.1						53		
38	26.0 20.3		26.8 20.9		27.6 21.5		28.4 22.2		29.2 22.8		29.9 23.4		30.7 24.0		31.5 24.6						52		
39	25.6 20.8		26.4 21.4		27.2 22.0		28.0 22.7		28.8 23.3		29.5 23.9		30.3 24.5		31.1 25.2						51		
40	25.3 21.2		26.0 21.9		26.8 22.5		27.6 23.1		28.3 23.8		29.1 24.4		29.9 25.1		30.6 25.7						50		
41	24.9 21.6		25.7 22.3		26.4 23.0		27.2 23.6		27.9 24.3		28.7 24.9		29.4 25.6		30.2 26.2						49		
42	24.5 22.1		25.3 22.8		26.0 23.4		26.8 24.1		27.5 24.8		28.2 25.4		29.0 26.1		29.7 26.8						48		
43	24.1 22.5		24.9 23.2		25.6 23.9		26.3 24.6		27.1 25.2		27.8 25.9		28.5 26.6		29.3 27.3						47		
44	23.7 22.9		24.5 23.6		25.2 24.3		25.9 25.0		26.6 25.7		27.3 26.4		28.1 27.1		28.8 27.8						46		
45	23.3 23.3		24.0 24.0		24.7 24.7		25.5 25.5		26.2 26.2		26.9 26.9		27.6 27.6		28.3 28.3						45		
Crs.	Dep.	Diff. Lat.	Dep.	Diff																			

Traverse Table.

(x.)

Distance. 41			42			43			44			45			46			47			48		
Crse	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse		
1	41.0 02.0		41.9 02.1		42.9 02.1		43.9 02.2		44.9 02.2		45.9 02.3		46.9 02.3		47.9 02.4		48.9 02.4		49.9 02.4		7		
2	40.8 04.0		41.8 04.1		42.8 04.2		43.8 04.3		44.8 04.4		45.8 04.5		46.8 04.6		47.8 04.7		48.8 04.7		49.8 04.7		6		
3	40.6 06.0		41.5 06.2		42.5 06.3		43.5 06.5		44.5 06.6		45.5 06.7		46.5 06.9		47.5 07.0		48.5 07.0		49.5 07.0		5		
4	40.2 08.0		41.2 08.2		42.2 08.4		43.2 08.6		44.1 08.8		45.1 09.0		46.1 09.2		47.1 09.4		48.1 09.4		49.1 09.4		4		
5	39.8 10.0		40.7 10.2		41.7 10.4		42.7 10.7		43.7 10.9		44.6 11.2		45.6 11.4		46.6 11.7		47.6 11.7		48.6 11.7		3		
6	39.2 11.9		40.2 12.2		41.2 12.5		42.1 12.8		43.1 13.1		44.0 13.3		45.0 13.6		45.9 13.9		46.9 13.9		47.9 13.9		2		
7	38.6 13.8		39.5 14.1		40.5 14.5		41.4 14.8		42.4 15.2		43.3 15.5		44.3 15.8		45.2 16.2		46.2 16.2		47.2 16.2		1		
8	37.9 15.7		38.8 16.1		39.7 16.5		40.6 16.8		41.6 17.2		42.5 17.6		43.4 18.0		44.4 18.4		45.4 18.4		46.4 18.4		0		
9	37.1 17.5		38.0 18.0		38.9 18.4		39.8 18.8		40.7 19.2		41.6 19.7		42.5 20.1		43.4 20.5		44.4 20.5		45.4 20.5		9		
10	36.2 19.3		37.0 19.8		37.9 20.3		38.8 20.7		39.7 21.2		40.6 21.7		41.5 22.2		42.3 22.6		43.3 22.6		44.3 22.6		8		
11	35.2 21.1		36.0 21.6		36.9 22.1		37.7 22.6		38.6 23.1		39.5 23.6		40.3 24.2		41.2 24.7		42.2 24.7		43.2 24.7		7		
12	34.1 22.8		34.9 23.3		35.8 23.9		36.6 24.4		37.4 25.0		38.2 25.6		39.1 26.1		39.9 26.7		40.9 26.7		41.9 26.7		6		
13	32.9 24.4		33.7 25.0		34.5 25.6		35.3 26.2		36.1 26.8		36.9 27.4		37.7 28.0		38.6 28.6		39.6 28.6		40.6 28.6		5		
14	31.7 26.0		32.5 26.6		33.2 27.3		34.0 27.9		34.8 28.5		35.6 29.2		36.3 29.8		37.1 30.4		38.1 30.4		39.1 30.4		4		
15	30.4 27.5		31.1 28.2		31.9 28.9		32.6 29.5		33.3 30.2		34.1 30.9		34.8 31.6		35.6 32.2		36.6 32.2		37.6 32.2		3		
16	29.0 29.0		29.7 29.7		30.4 30.4		31.1 31.1		31.8 31.8		32.5 32.5		33.2 33.2		33.9 33.9		34.9 33.9		35.9 33.9		2		
17	41.0 00.7		42.0 00.7		43.0 00.8		44.0 00.8		45.0 00.8		46.0 00.8		47.0 00.8		48.0 00.8		49.0 00.8		50.0 00.8		1		
18	41.0 01.4		42.0 01.5		43.0 01.5		44.0 01.5		45.0 01.6		46.0 01.6		47.0 01.6		48.0 01.7		49.0 01.7		50.0 01.7		0		
19	40.9 02.1		41.9 02.2		42.9 02.3		43.9 02.3		44.9 02.4		45.9 02.4		46.9 02.5		47.9 02.5		48.9 02.5		49.9 02.5		9		
20	40.9 02.9		41.9 02.9		42.9 03.0		43.9 03.1		44.9 03.1		45.9 03.2		46.9 03.3		47.9 03.3		48.9 03.3		49.9 03.3		8		
21	40.8 03.6		41.8 03.7		42.8 03.7		43.8 03.8		44.8 03.9		45.8 04.0		46.8 04.1		47.8 04.2		48.8 04.2		49.8 04.2		7		
22	40.8 04.3		41.8 04.4		42.8 04.5		43.8 04.6		44.8 04.7		45.7 04.8		46.7 04.9		47.7 05.0		48.7 05.0		49.7 05.0		6		
23	40.7 05.0		41.7 05.1		42.7 05.2		43.7 05.4		44.7 05.5		45.7 05.6		46.6 05.7		47.6 05.8		48.6 05.8		49.6 05.8		5		
24	40.6 05.7		41.6 05.8		42.6 06.0		43.6 06.1		44.6 06.3		45.6 06.4		46.5 06.5		47.5 06.7		48.5 06.7		49.5 06.7		4		
25	40.5 06.4		41.5 06.6		42.5 06.7		43.5 06.9		44.4 07.0		45.4 07.2		46.4 07.4		47.4 07.5		48.4 07.5		49.4 07.5		3		
26	40.4 07.1		41.4 07.3		42.3 07.5		43.3 07.6		44.3 07.8		45.3 08.0		46.3 08.2		47.3 08.3		48.3 08.3		49.3 08.3		2		
27	40.2 07.8		41.2 08.0		42.2 08.2		43.2 08.4		44.2 08.6		45.2 08.8		46.1 09.0		47.1 09.2		48.1 09.2		49.1 09.2		1		
28	40.1 08.5		41.1 08.7		42.1 08.9		43.0 09.1		44.0 09.4		45.0 09.6		46.0 09.8		47.0 10.0		48.0 10.0		49.0 10.0		0		
29	39.9 09.2		40.9 09.4		41.9 09.7		42.9 09.9		43.8 10.1		44.8 10.3		45.8 10.6		46.8 10.8		47.8 10.8		48.8 10.8		9		
30	39.8 09.9		40.8 10.2		41.7 10.4		42.7 10.6		43.7 10.9		44.6 11.1		45.6 11.4		46.6 11.6		47.6 11.6		48.6 11.6		8		
31	39.6 10.6		40.6 10.9		41.5 11.1		42.5 11.4		43.5 11.6		44.4 11.9		45.4 12.2		46.4 12.4		47.4 12.4		48.4 12.4		7		
32	39.4 11.3		40.4 11.6		41.3 11.9		42.3 12.1		43.3 12.4		44.2 12.7		45.2 13.0		46.1 13.2		47.1 13.2		48.1 13.2		6		
33	39.2 12.0		40.2 12.3		41.1 12.6		42.1 12.9		43.0 13.2		44.0 13.4		44.9 13.7		45.9 14.0		46.9 14.0		47.9 14.0		5		
34	39.0 12.7		39.9 13.0		40.9 13.3		41.8 13.6		42.8 13.9		43.7 14.2		44.7 14.5		45.7 14.8		46.7 14.8		47.7 14.8		4		
35	38.8 13.3		39.7 13.7		40.7 14.0		41.6 14.3		42.5 14.7		43.5 15.0		44.4 15.3		45.4 15.6		46.4 15.6		47.4 15.6		3		
36	38.5 14.0		39.5 14.4		40.4 14.7		41.3 15.0		42.3 15.4		43.2 15.7		44.2 16.1		45.1 16.4		46.1 16.4		47.1 16.4		2		
37	38.3 14.7		39.2 15.1		40.1 15.4		41.1 15.8		42.0 16.1		42.9 16.5		43.9 16.8		44.8 17.2		45.8 17.2		46.8 17.2		1		
38	38.0 15.4		38.9 15.7		39.9 16.1		40.8 16.5		41.7 16.9		42.7 17.2		43.6 17.6		44.5 18.0		45.5 18.0		46.5 18.0		0		
39	37.7 16.0		38.7 16.4		39.6 16.8		40.5 17.2		41.4 17.6		42.3 18.0		43.3 18.4		44.2 18.8		45.2 18.8		46.2 18.8		9		
40	37.5 16.7		38.4 17.1		39.3 17.5		40.2 17.9		41.1 18.3		42.0 18.7		42.9 19.1		43.9 19.5		44.8 19.5		45.8 19.5		8		
41	37.2 17.3		38.1 17.7		39.0 18.2		39.9 18.6		40.8 19.0		41.7 19.4		42.6 19.9		43.5 20.3		44.5 20.3		45.5 20.3		7		
42	36.9 18.0		37.7 18.4		38.6 18.8		39.5 19.3		40.4 19.7		41.3 20.2		42.2 20.6		43.1 21.0		44.1 21.0		45.1 21.0		6		
43	36.5 18.6		37.4 19.1		38.3 19.5		39.2 20.0		40.1 20.4		41.0 20.9		41.9 21.3		42.8 21.8		43.8 21.8		44.8 21.8		5		
44	36.2 19.2		37.1 19.7		38.0 20.2		38.9 20.7		39.7 21.1		40.6 21.6		41.5 22.1		42.4 22.5		43.4 22.5		44.4 22.5		4		
45	35.9 19.9		36.7 20.4		37.6 20.8		38.5 21.3		39.4 21.8		40.2 22.3		41.1 22.8		42.0 23.3		43.0 23.3		44.0 23.3		3		
46	35.5 20.5		36.4 21.0		37.2 21.5		38.1 22.0		39.0 22.5		39.8 23.0		40.7 23.5		41.6 24.0		42.6 24.0		43.6 24.0		2		
47	35.1 21.1		36.0 21.6		36.9 22.1		37.7 22.7		38.6 23.2		39.4 23.7		40.3 24.2		41.2 24.7		42.2 24.7		43.2 24.7		1		
48	34.8 21.7		35.6 22.3		36.5 22.8		37.3 23.3		38.2 23.8		39.0 24.4		39.9 24.9		40.7 25.4		41.7 25.4		42.7 25.4		0		
49	34.4 22.3		35.2 22.9		36.1 23.4		36.9 24.0		37.7 24.5		38.6 25.1		39.4 25.6		40.3 26.1		41.3 26.1		42.3 26.1		9		
50	34.0 22.9		34.8 23.5		35.6 24.0		36.5 24.6		37.3 25.2		38.1 25.7		39.0 26.3		39.8 26.8		40.8 26.8		41.8 26.8		8		
51	33.6 23.5		34.4 24.1		35.2 24.7		36.0 25.2		36.9 25.8		37.7 26.4		38.5 27.0		39.3 27.5		40.3 27.5		41.3 27.5		7		
52	33.2 24.1		34.0 24.7		34.8 25.3		35.6 25.9		36.4 26.5		37.2 27.0		38.0 27.6		38.8 28.2		39.8 28.2		40.8 28.2		6		
53	32.7 24.7		33.5 25.3		34.3 25.9		35.1 26.5		35.9 27.1		36.7 27.7		37.5 28.3		38.3 28.9		39.3 28.9		40.3 28.9		5		
54	32.3 25.2		33.1 25.9		33.9 26.5		34.7 27.1		35.5 27.7		36.2 28.3		37.0 28.9		37.8 29.5		38.8 29.5		39.8 29.5		4		
55	31.9 25.8		32.6 26.4		33.4 27.1		34.2 27.7		35.0 28.3		35.7 28.9												

Traverse Table.

(x.)

Distance. 49			50		51			52		53			54			55			56		
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse.
1	48.9 02.4	49.9 02.5	50.9 02.5	51.9 02.6	52.9 02.6	53.9 02.7	54.9 02.7	55.9 02.8	56.9 02.8	57.9 02.8	58.9 02.8	59.9 02.8	60.9 02.8	61.9 02.8	62.9 02.8	63.9 02.8	64.9 02.8	65.9 02.8	66.9 02.8	67.9 02.8	7
2	48.8 04.8	49.8 04.9	50.8 05.0	51.7 05.1	52.7 05.2	53.7 05.3	54.7 05.4	55.7 05.5	56.7 05.5	57.7 05.5	58.7 05.5	59.7 05.5	60.7 05.5	61.7 05.5	62.7 05.5	63.7 05.5	64.7 05.5	65.7 05.5	66.7 05.5	67.7 05.5	8
3	48.5 07.2	49.5 07.3	50.4 07.5	51.4 07.6	52.4 07.8	53.4 07.9	54.4 08.1	55.4 08.2	56.4 08.2	57.4 08.2	58.4 08.2	59.4 08.2	60.4 08.2	61.4 08.2	62.4 08.2	63.4 08.2	64.4 08.2	65.4 08.2	66.4 08.2	67.4 08.2	9
4	48.1 09.6	49.0 09.8	50.0 10.0	51.0 10.1	52.0 10.3	53.0 10.5	53.9 10.7	54.9 10.9	55.9 10.9	56.9 10.9	57.9 10.9	58.9 10.9	59.9 10.9	60.9 10.9	61.9 10.9	62.9 10.9	63.9 10.9	64.9 10.9	65.9 10.9	66.9 10.9	10
5	47.5 11.9	48.5 12.2	49.5 12.4	50.4 12.6	51.4 12.9	52.4 13.1	53.4 13.4	54.3 13.6	55.3 13.6	56.3 13.6	57.3 13.6	58.3 13.6	59.3 13.6	60.3 13.6	61.3 13.6	62.3 13.6	63.3 13.6	64.3 13.6	65.3 13.6	66.3 13.6	11
6	46.9 14.2	47.9 14.5	48.8 14.8	49.8 15.1	50.7 15.4	51.7 15.7	52.6 16.0	53.6 16.3	54.6 16.3	55.6 16.3	56.6 16.3	57.6 16.3	58.6 16.3	59.6 16.3	60.6 16.3	61.6 16.3	62.6 16.3	63.6 16.3	64.6 16.3	65.6 16.3	12
7	46.1 16.5	47.1 16.8	48.0 17.2	49.0 17.5	49.9 17.9	50.8 18.2	51.8 18.5	52.7 18.9	53.7 18.9	54.7 18.9	55.7 18.9	56.7 18.9	57.7 18.9	58.7 18.9	59.7 18.9	60.7 18.9	61.7 18.9	62.7 18.9	63.7 18.9	64.7 18.9	13
8	45.3 18.8	46.2 19.1	47.1 19.5	48.0 19.9	49.0 20.3	49.9 20.7	50.8 21.0	51.7 21.4	52.7 21.4	53.7 21.4	54.7 21.4	55.7 21.4	56.7 21.4	57.7 21.4	58.7 21.4	59.7 21.4	60.7 21.4	61.7 21.4	62.7 21.4	63.7 21.4	14
9	44.3 21.0	45.2 21.4	46.1 21.8	47.0 22.2	47.9 22.7	48.8 23.1	49.7 23.5	50.6 23.9	51.6 23.9	52.6 23.9	53.6 23.9	54.6 23.9	55.6 23.9	56.6 23.9	57.6 23.9	58.6 23.9	59.6 23.9	60.6 23.9	61.6 23.9	62.6 23.9	15
10	43.2 23.1	44.1 23.6	45.0 24.0	45.9 24.5	46.7 25.0	47.6 25.5	48.5 25.9	49.4 26.4	50.4 26.4	51.4 26.4	52.4 26.4	53.4 26.4	54.4 26.4	55.4 26.4	56.4 26.4	57.4 26.4	58.4 26.4	59.4 26.4	60.4 26.4	61.4 26.4	16
11	42.0 25.2	42.9 25.7	43.7 26.2	44.6 26.7	45.5 27.2	46.3 27.8	47.2 28.3	48.0 28.8	48.9 28.8	49.9 28.8	50.8 28.8	51.8 28.8	52.8 28.8	53.8 28.8	54.8 28.8	55.8 28.8	56.8 28.8	57.8 28.8	58.8 28.8	59.8 28.8	17
12	40.7 27.2	41.6 27.8	42.4 28.3	43.2 28.9	44.1 29.4	44.9 30.0	45.7 30.6	46.6 31.1	47.6 31.1	48.6 31.1	49.6 31.1	50.6 31.1	51.6 31.1	52.6 31.1	53.6 31.1	54.6 31.1	55.6 31.1	56.6 31.1	57.6 31.1	58.6 31.1	18
13	39.4 29.2	40.2 29.8	41.0 30.4	41.8 31.0	42.6 31.6	43.4 32.2	44.2 32.8	45.0 33.4	45.9 33.4	46.9 33.4	47.9 33.4	48.9 33.4	49.9 33.4	50.9 33.4	51.9 33.4	52.9 33.4	53.9 33.4	54.9 33.4	55.9 33.4	56.9 33.4	19
14	37.9 31.1	38.6 31.7	39.4 32.3	40.2 33.0	41.0 33.6	41.7 34.3	42.5 34.9	43.3 35.5	44.2 35.5	45.2 35.5	46.2 35.5	47.2 35.5	48.2 35.5	49.2 35.5	50.2 35.5	51.2 35.5	52.2 35.5	53.2 35.5	54.2 35.5	55.2 35.5	20
15	36.3 32.9	37.0 33.6	37.8 34.2	38.5 34.9	39.3 35.6	40.0 36.3	40.7 36.9	41.5 37.6	42.4 37.6	43.4 37.6	44.4 37.6	45.4 37.6	46.4 37.6	47.4 37.6	48.4 37.6	49.4 37.6	50.4 37.6	51.4 37.6	52.4 37.6	53.4 37.6	21
16	34.6 34.6	35.4 35.4	36.1 36.1	36.8 36.8	37.5 37.5	38.2 38.2	38.9 38.9	39.6 39.6	40.4 39.6	41.2 39.6	42.0 39.6	42.8 39.6	43.6 39.6	44.4 39.6	45.2 39.6	46.0 39.6	46.8 39.6	47.6 39.6	48.4 39.6	49.2 39.6	22
17	49.0 00.9	50.0 00.9	51.0 00.9	52.0 00.9	53.0 00.9	54.0 00.9	55.0 01.0	56.0 01.0	57.0 01.0	58.0 01.0	59.0 01.0	60.0 01.0	61.0 01.0	62.0 01.0	63.0 01.0	64.0 01.0	65.0 01.0	66.0 01.0	67.0 01.0	68.0 01.0	23
18	49.0 01.7	50.0 01.7	51.0 01.8	52.0 01.8	53.0 01.8	54.0 01.9	55.0 01.9	56.0 02.0	57.0 02.0	58.0 02.0	59.0 02.0	60.0 02.0	61.0 02.0	62.0 02.0	63.0 02.0	64.0 02.0	65.0 02.0	66.0 02.0	67.0 02.0	68.0 02.0	24
19	48.9 02.6	49.9 02.6	50.9 02.7	51.9 02.7	52.9 02.8	53.9 02.8	54.9 02.9	55.9 02.9	56.9 02.9	57.9 02.9	58.9 02.9	59.9 02.9	60.9 02.9	61.9 02.9	62.9 02.9	63.9 02.9	64.9 02.9	65.9 02.9	66.9 02.9	67.9 02.9	25
20	48.9 03.4	49.9 03.5	50.9 03.6	51.9 03.6	52.9 03.7	53.9 03.8	54.9 03.8	55.9 03.9	56.9 03.9	57.9 03.9	58.9 03.9	59.9 03.9	60.9 03.9	61.9 03.9	62.9 03.9	63.9 03.9	64.9 03.9	65.9 03.9	66.9 03.9	67.9 03.9	26
21	48.8 04.3	49.8 04.4	50.8 04.4	51.8 04.5	52.8 04.6	53.8 04.7	54.8 04.8	55.8 04.8	56.8 04.8	57.8 04.8	58.8 04.8	59.8 04.8	60.8 04.8	61.8 04.8	62.8 04.8	63.8 04.8	64.8 04.8	65.8 04.8	66.8 04.8	67.8 04.8	27
22	48.7 05.1	49.7 05.2	50.7 05.3	51.7 05.4	52.7 05.5	53.7 05.6	54.7 05.7	55.7 05.9	56.7 05.9	57.7 05.9	58.7 05.9	59.7 05.9	60.7 05.9	61.7 05.9	62.7 05.9	63.7 05.9	64.7 05.9	65.7 05.9	66.7 05.9	67.7 05.9	28
23	48.6 06.0	49.6 06.1	50.6 06.2	51.6 06.3	52.6 06.5	53.6 06.6	54.6 06.7	55.6 06.8	56.6 06.8	57.6 06.8	58.6 06.8	59.6 06.8	60.6 06.8	61.6 06.8	62.6 06.8	63.6 06.8	64.6 06.8	65.6 06.8	66.6 06.8	67.6 06.8	29
24	48.5 06.8	49.5 07.0	50.5 07.1	51.5 07.2	52.5 07.4	53.5 07.5	54.5 07.7	55.5 07.8	56.5 07.8	57.5 07.8	58.5 07.8	59.5 07.8	60.5 07.8	61.5 07.8	62.5 07.8	63.5 07.8	64.5 07.8	65.5 07.8	66.5 07.8	67.5 07.8	30
25	48.4 07.7	49.4 07.8	50.4 08.0	51.4 08.1	52.3 08.3	53.3 08.4	54.3 08.6	55.3 08.8	56.3 08.8	57.3 08.8	58.3 08.8	59.3 08.8	60.3 08.8	61.3 08.8	62.3 08.8	63.3 08.8	64.3 08.8	65.3 08.8	66.3 08.8	67.3 08.8	31
26	48.3 08.5	49.2 08.7	50.2 08.9	51.2 09.0	52.0 09.2	53.0 09.4	54.2 09.6	55.1 09.7	56.1 09.7	57.1 09.7	58.1 09.7	59.1 09.7	60.1 09.7	61.1 09.7	62.1 09.7	63.1 09.7	64.1 09.7	65.1 09.7	66.1 09.7	67.1 09.7	32
27	48.1 09.3	49.1 09.5	50.1 09.7	51.0 09.9	52.0 10.1	53.0 10.3	54.0 10.5	55.0 10.7	56.0 10.7	57.0 10.7	58.0 10.7	59.0 10.7	60.0 10.7	61.0 10.7	62.0 10.7	63.0 10.7	64.0 10.7	65.0 10.7	66.0 10.7	67.0 10.7	33
28	47.9 10.2	48.9 10.4	49.9 10.6	50.9 10.8	51.8 11.0	52.8 11.2	53.8 11.4	54.8 11.6	55.8 11.6	56.8 11.6	57.8 11.6	58.8 11.6	59.8 11.6	60.8 11.6	61.8 11.6	62.8 11.6	63.8 11.6	64.8 11.6	65.8 11.6	66.8 11.6	34
29	47.7 11.0	48.7 11.2	49.7 11.5	50.7 11.7	51.6 11.9	52.6 12.1	53.6 12.4	54.6 12.6	55.6 12.6	56.6 12.6	57.6 12.6	58.6 12.6	59.6 12.6	60.6 12.6	61.6 12.6	62.6 12.6	63.6 12.6	64.6 12.6	65.6 12.6	66.6 12.6	35
30	47.5 11.9	48.5 12.1	49.5 12.3	50.5 12.6	51.4 12.8	52.4 13.1	53.4 13.3	54.3 13.5	55.3 13.5	56.3 13.5	57.3 13.5	58.3 13.5	59.3 13.5	60.3 13.5	61.3 13.5	62.3 13.5	63.3 13.5	64.3 13.5	65.3 13.5	66.3 13.5	36
31	47.3 12.7	48.3 12.9	49.3 13.2	50.2 13.5	51.2 13.7	52.2 14.0	53.1 14.2	54.1 14.5	55.1 14.5	56.1 14.5	57.1 14.5	58.1 14.5	59.1 14.5	60.1 14.5	61.1 14.5	62.1 14.5	63.1 14.5	64.1 14.5	65.1 14.5	66.1 14.5	37
32	47.1 13.5	48.1 13.8	49.0 14.1	50.0 14.3	50.9 14.6	51.9 14.9	52.9 15.2	53.8 15.4	54.8 15.4	55.8 15.4	56.8 15.4	57.8 15.4	58.8 15.4	59.8 15.4	60.8 15.4	61.8 15.4	62.8 15.4	63.8 15.4	64.8 15.4	65.8 15.4	38
33	46.9 14.3	47.8 14.6	48.8 14.9	49.7 15.2	50.7 15.5	51.6 15.8	52.6 16.1	53.6 16.4	54.6 16.4	55.6 16.4	56.6 16.4	57.6 16.4	58.6 16.4	59.6 16.4	60.6 16.4	61.6 16.4	62.6 16.4	63.6 16.4	64.6 16.4	65.6 16.4	39
34	46.6 15.1	47.6 15.5	48.5 15.8	49.5 16.1	50.4 16.4	51.4 16.7	52.3 17.0	53.3 17.3	54.3 17.3	55.3 17.3	56.3 17.3	57.3 17.3	58.3 17.3	59.3 17.3	60.3 17.3	61.3 17.3	62.3 17.3	63.3 17.3	64.3 17.3	65.3 17.3	40
35	46.3 16.0	47.3 16.3	48.2 16.6	49.2 16.9	50.1 17.3	51.1 17.6	52.0 17.9	52.9 18.2	53.9 18.2	54.9 18.2	55.9 18.2	56.9 18.2	57.9 18.2	58.9 18.2	59.9 18.2	60.9 18.2	61.9 18.2	62.9 18.2	63.9 18.2	64.9 18.2	41
36	46.0 16.8	47.0 17.1	47.9 17.4	48.9 17.8	49.8 18.1	50.7 18.5	51.7 18.8	52.6 19.2	53.6 19.2	54.6 19.2	55.6 19.2	56.6 19.2	57.6 19.2	58.6 19.2	59.6 19.2	60.6 19.2	61.6 19.2	62.6 19.2	63.6 19.2	64.6 19.2	42
37	45.7 17.6	46.7 17.9	47.6 18.3	48.5 18.6	49.5 19.0	50.4 19.4	51.3 19.7	52.3 20.1	53.3 20.1	54.3 20.1	55.3 20.1	56.3 20.1	57.3 20.1	58.3 20.1	59.3 20.1	60.3 20.1	61.3 20.1	62.3 20.1	63.3 20.1	64.3 20.1	43
38	45.4 18.4	46.4 18.7	47.3 19.1	48.2 19.5	49.1 19.9	50.1 20.2	51.0 20.6	51.9 21.0	52.9 21.0	53.9 21.0	54.9 21.0	55.9 21.0	56.9 21.0	57.9 21.0	58.9 21.0	59.9 21.0	60.9 21.0	61.9 21.0	62.9 21.0	63.9 21.0	44
39	45.1 19.1	46.0 19.5	46.9 19.9	47.9 20.3	48.8 20.7	49.7 21.1	50.6 21.5	51.5 21.9	52.5 21.9	53.5 21.9	54.5 21.9	55.5 21.9	56.5 21.9	57.5 21.9	58.5 21.9	59.5 21.9	60.5 21.9	61.5 21.9	62.5 21.9	63.5 21.9	45
40	44.8 19.9	45.7 20.3	46.6 20.7	47.5 21.2	48.4 21.6	49.3 22.0	50.2 22.4	51.2 22.8	52.2 22.8	53.2 22.8	54										

Traverse Table.

(x.)

Distance. 57			58			59			60			61			62			63			64			Crs.
Case.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.			
1	56.9	02.8		57.9	02.9		58.9	02.9		59.9	02.9		60.9	03.0		61.9	03.0		62.9	03.1		63.9	03.1	89°
2	56.7	05.6		57.7	05.7		58.7	05.8		59.7	05.9		60.7	06.0		61.7	06.1		62.7	06.2		63.7	06.3	88
3	56.4	08.4		57.4	08.5		58.4	08.7		59.3	08.8		60.3	08.9		61.3	09.1		62.3	09.2		63.3	09.4	87
4	55.9	11.1		56.9	11.3		57.9	11.5		58.8	11.7		59.8	11.9		60.8	12.1		61.8	12.3		62.8	12.5	7
5	55.3	13.9		56.3	14.1		57.2	14.3		58.2	14.6		59.2	14.8		60.1	15.1		61.1	15.3		62.1	15.6	3
6	54.5	16.5		55.5	16.8		56.5	17.1		57.4	17.4		58.4	17.7		59.3	18.0		60.3	18.3		61.2	18.6	3
7	53.7	19.2		54.6	19.5		55.5	19.9		56.5	20.2		57.4	20.5		58.4	20.9		59.3	21.2		60.3	21.6	3
8	52.7	21.8		53.6	22.2		54.5	22.6		55.4	23.0		56.4	23.3		57.3	23.7		58.2	24.1		59.1	24.5	6
9	51.5	24.4		52.4	24.8		53.3	25.2		54.2	25.7		55.1	26.1		56.0	26.5		57.0	26.9		57.9	27.4	3
10	50.3	26.9		51.2	27.3		52.0	27.8		52.9	28.3		53.8	28.8		54.7	29.2		55.6	29.7		56.4	30.2	3
11	48.9	29.3		49.7	29.8		50.6	30.3		51.5	30.8		52.3	31.4		53.2	31.9		54.0	32.4		54.9	32.9	3
12	47.4	31.7		48.2	32.2		49.1	32.8		49.9	33.3		50.7	33.9		51.5	34.4		52.4	35.0		53.2	35.6	5
13	45.8	34.0		46.6	34.6		47.4	35.1		48.2	35.7		49.0	36.3		49.8	36.9		50.6	37.5		51.4	38.1	3
14	44.1	36.2		44.8	36.8		45.6	37.4		46.4	38.1		47.1	38.7		47.9	39.3		48.7	40.0		49.5	40.6	3
15	42.2	38.3		43.0	38.9		43.7	39.6		44.5	40.3		45.2	41.0		45.9	41.6		46.7	42.3		47.4	43.0	3
16	40.3	40.3		41.0	41.0		41.7	41.7		42.4	42.4		43.1	43.1		43.8	43.8		44.5	44.5		45.3	45.3	4
17	57.0	01.0		58.0	01.0		59.0	01.0		60.0	01.0		61.0	01.0		62.0	01.1		63.0	01.1		64.0	01.1	89°
18	57.0	02.0		58.0	02.0		59.0	02.1		60.0	02.1		61.0	02.1		62.0	02.2		63.0	02.2		64.0	02.2	88
19	56.9	03.0		57.9	03.0		58.9	03.1		59.9	03.1		60.9	03.2		61.9	03.2		62.9	03.3		63.9	03.3	87
20	56.9	04.0		57.9	04.0		58.9	04.1		59.9	04.2		60.9	04.3		61.8	04.3		62.8	04.4		63.8	04.5	86
21	56.8	05.0		57.8	05.1		58.8	05.1		59.8	05.2		60.8	05.3		61.8	05.4		62.8	05.5		63.8	05.6	85
22	56.7	06.0		57.7	06.1		58.7	06.2		59.7	06.3		60.7	06.4		61.7	06.5		62.7	06.6		63.6	06.7	84
23	56.6	06.9		57.6	07.1		58.6	07.2		59.6	07.3		60.5	07.4		61.5	07.6		62.5	07.7		63.5	07.8	83
24	56.4	07.9		57.4	08.1		58.4	08.2		59.4	08.4		60.4	08.5		61.4	08.6		62.4	08.8		63.4	08.9	82
25	56.3	08.9		57.3	09.1		58.3	09.2		59.3	09.4		60.2	09.5		61.2	09.7		62.2	09.9		63.2	10.0	81
26	56.1	09.9		57.1	10.1		58.1	10.2		59.1	10.4		60.1	10.6		61.1	10.8		62.0	10.9		63.0	11.1	80
27	56.0	10.9		56.9	11.1		57.9	11.3		58.9	11.4		59.9	11.6		60.9	11.8		61.8	12.0		62.8	12.2	79
28	55.8	11.9		56.7	12.1		57.7	12.3		58.7	12.5		59.7	12.7		60.6	12.9		61.6	13.1		62.6	13.3	78
29	55.5	12.8		56.5	13.0		57.5	13.3		58.5	13.5		59.4	13.7		60.4	13.9		61.4	14.2		62.4	14.4	77
30	55.3	13.8		56.3	14.0		57.2	14.3		58.2	14.5		59.2	14.8		60.2	15.0		61.1	15.2		62.1	15.5	76
31	55.1	14.8		56.0	15.0		57.0	15.3		58.0	15.5		58.9	15.8		59.9	16.0		60.9	16.3		61.8	16.6	75
32	54.8	15.7		55.8	16.0		56.7	16.3		57.7	16.5		58.6	16.8		59.6	17.1		60.6	17.4		61.5	17.6	74
33	54.5	16.7		55.5	17.0		56.4	17.2		57.4	17.5		58.3	17.8		59.3	18.1		60.2	18.4		61.2	18.7	73
34	54.2	17.6		55.2	17.9		56.1	18.2		57.1	18.5		58.0	18.9		59.0	19.2		59.9	19.5		60.9	19.8	72
35	53.9	18.6		54.8	18.9		55.8	19.2		56.7	19.5		57.7	19.9		58.6	20.2		59.6	20.5		60.5	20.8	71
36	53.6	19.5		54.5	19.8		55.4	20.1		56.4	20.5		57.3	20.9		58.3	21.2		59.2	21.5		60.1	21.9	70
37	53.2	20.4		54.1	20.8		55.1	21.1		56.0	21.5		56.9	21.9		57.9	22.2		58.8	22.6		59.7	22.9	69
38	52.8	21.4		53.8	21.7		54.7	22.1		55.6	22.5		56.6	22.9		57.5	23.2		58.4	23.6		59.3	24.0	68
39	52.5	22.3		53.4	22.7		54.3	23.1		55.2	23.4		56.2	23.8		57.1	24.2		58.0	24.6		58.9	25.0	67
40	52.1	23.2		53.0	23.6		53.9	24.0		54.8	24.4		55.7	24.8		56.6	25.2		57.6	25.6		58.5	26.0	66
41	51.7	24.1		52.6	24.5		53.5	24.9		54.4	25.4		55.3	25.8		56.2	26.2		57.1	26.6		58.0	27.0	65
42	51.2	25.0		52.1	25.4		53.0	25.9		53.9	26.3		54.8	26.7		55.7	27.2		56.6	27.6		57.5	28.1	64
43	50.8	25.9		51.7	26.3		52.6	26.8		53.5	27.2		54.4	27.7		55.2	28.1		56.1	28.6		57.0	29.1	63
44	50.3	26.8		51.2	27.2		52.1	27.7		53.0	28.2		53.9	28.6		54.7	29.1		55.6	29.6		56.5	30.0	62
45	49.9	27.6		50.7	28.1		51.6	28.6		52.5	29.1		53.4	29.6		54.2	30.1		55.1	30.5		56.0	31.0	61
46	49.4	28.5		50.2	29.0		51.1	29.5		52.0	30.0		52.8	30.5		53.7	31.0		54.6	31.5		55.4	32.0	60
47	48.9	29.4		49.7	29.9		50.6	30.4		51.4	30.9		52.3	31.4		53.1	31.9		54.0	32.4		54.9	33.0	59
48	48.3	30.2		49.2	30.7		50.0	31.3		50.9	31.8		51.7	32.3		52.6	32.9		53.4	33.4		54.3	33.9	58
49	47.8	31.0		48.6	31.6		49.5	32.1		50.3	32.7		51.2	33.2		52.0	33.8		52.8	34.3		53.7	34.9	57
50	47.3	31.9		48.1	32.4		48.9	33.0		49.7	33.6		50.6	34.1		51.4	34.7		52.2	35.2		53.1	35.8	56
51	46.7	32.7		47.5	33.3		48.3	33.8		49.1	34.4		50.0	35.0		50.8	35.6		51.6	36.1		52.4	36.7	55
52	46.1	33.5		46.9	34.1		47.7	34.7		48.5	35.3		49.4	35.9		50.2	36.4		51.0	37.0		51.8	37.6	54
53	45.5	34.3		46.3	34.9		47.1	35.5		47.9	36.1		48.7	36.7		49.5	37.3		50.3	37.9		51.1	38.5	53
54	44.9	35.1		45.7	35.7		46.5	36.3		47.3	36.9		48.1	37.6		48.9	38.2		49.6	38.8		50.4	39.4	52
55	44.3	35.9		45.1	36.5		45.9	37.1		46.6	37.8		47.4	38.4		48.2	39.0		49.0	39.6		49.7	40.3	51
56	43.7	36.6		44.4	37.3		45.2	37.9		46.0	38.6		46.7	39.2		47.5	39.9		48.3	40.5		49.0	41.1	50
57	43.0	37.4		43.8	38.1		44.5	38.7		45.3	39.4		46.0	40.0		46.8	40.7		47.5	41.3		48.3	42.0	49
58	42.4	38.1		43.1	38.8		43.8	39.5		44.6	40.1		45.3	40.8		46.1	41.5		46.8	42.2		47.6	42.8	48
59	41.7	38.9		42.4	39.6		43.1	40.2		43.9	40.9		44.6	41.6		45.3	42.3		46.1	43.0		46.8	43.6	47
60	41.0	39.6		41.7	40.3		42.4	41.0		43.2	41.7		43.9	42.4		44.6	43.1		45.3	43.8		46.0	44.5	46
61	40.3	40.3		41.0	41.0		41.7	41.7		42.4	42.4		43.1	43.1		43.8	43.8		44.5	44.5		45.3	45.3	45
Crs.	Dep.	Diff. Lat.		Dep.	Diff. Lat.		Dep.	Diff. Lat.		Dep.	Diff. Lat.		Dep.	Diff. Lat.		Dep.	Diff. Lat.		Dep.	Diff. Lat.		Dep.	Diff. Lat.	Crs.

Traverse Table.

(x.)

Distance. 65			66		67			68		69			70			71			72		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.
1	64.9 03.2		65.9 03.2		66.9 03.3		67.9 03.3		68.9 03.4		69.9 03.4		70.9 03.5		71.9 03.5		72.9 03.5		73.9 03.5		2
2	64.7 06.4		65.7 06.5		66.7 06.6		67.7 06.7		68.7 06.8		69.7 06.9		70.7 07.0		71.7 07.1		72.7 07.1		73.7 07.1		3
3	64.3 09.5		65.3 09.7		66.3 09.8		67.3 10.0		68.2 10.1		69.2 10.3		70.2 10.4		71.2 10.6		72.2 10.6		73.2 10.6		4
4	63.7 12.7		64.7 12.9		65.7 13.1		66.7 13.3		67.7 13.5		68.7 13.7		69.6 13.9		70.6 14.0		71.6 14.0		72.6 14.0		5
5	63.1 15.8		64.0 16.0		65.0 16.3		66.0 16.5		66.9 16.8		67.9 17.0		68.9 17.3		69.8 17.5		70.8 17.5		71.8 17.5		6
6	62.2 18.9		63.2 19.2		64.1 19.4		65.1 19.7		66.0 20.0		67.0 20.3		67.9 20.6		68.9 20.9		69.9 20.9		70.9 20.9		7
7	61.2 21.9		62.1 22.2		63.1 22.6		64.0 22.9		65.0 23.2		65.9 23.6		66.8 23.9		67.8 24.3		68.8 24.3		69.8 24.3		8
8	60.1 24.9		61.0 25.3		61.9 25.6		62.8 26.0		63.8 26.4		64.7 26.8		65.6 27.2		66.5 27.6		67.5 27.6		68.5 27.6		9
9	58.8 27.8		59.7 28.2		60.6 28.6		61.5 29.1		62.4 29.5		63.3 29.9		64.2 30.4		65.1 30.8		66.1 30.8		67.1 30.8		10
10	57.3 30.6		58.2 31.1		59.1 31.6		60.0 32.1		60.9 32.5		61.7 33.0		62.6 33.5		63.5 33.9		64.5 33.9		65.5 33.9		11
11	55.8 33.4		56.6 33.9		57.5 34.4		58.3 35.0		59.2 35.5		60.0 36.0		60.9 36.5		61.8 37.0		62.8 37.0		63.8 37.0		12
12	54.0 36.1		54.9 36.7		55.7 37.2		56.5 37.8		57.4 38.3		58.2 38.9		59.0 39.4		59.9 40.0		60.9 40.0		61.9 40.0		13
13	52.2 38.7		53.0 39.3		53.8 39.9		54.6 40.5		55.4 41.1		56.2 41.7		57.0 42.3		57.8 42.9		58.8 42.9		59.8 42.9		14
14	50.2 41.2		51.0 41.9		51.8 42.5		52.6 43.1		53.3 43.8		54.1 44.4		54.9 45.0		55.7 45.7		56.7 45.7		57.7 45.7		15
15	48.2 43.6		48.9 44.3		49.6 45.0		50.4 45.7		51.1 46.3		51.9 47.0		52.6 47.7		53.3 48.3		54.3 48.3		55.3 48.3		16
16	46.0 46.0		46.7 46.7		47.4 47.4		48.1 48.1		48.8 48.8		49.5 49.5		50.2 50.2		50.9 50.9		51.9 50.9		52.9 50.9		17
17	65.0 01.1		66.0 01.2		67.0 01.2		68.0 01.2		69.0 01.2		70.0 01.2		71.0 01.2		72.0 01.3		73.0 01.3		74.0 01.3		18
18	65.0 02.3		66.0 02.3		67.0 02.3		68.0 02.4		69.0 02.4		70.0 02.4		71.0 02.5		72.0 02.5		73.0 02.5		74.0 02.5		19
19	64.9 03.4		65.9 03.5		66.9 03.5		67.9 03.6		68.9 03.6		69.9 03.7		70.9 03.7		71.9 03.8		72.9 03.8		73.9 03.8		20
20	64.8 04.5		65.8 04.6		66.8 04.7		67.8 04.7		68.8 04.8		69.8 04.9		70.8 05.0		71.8 05.0		72.8 05.0		73.8 05.0		21
21	64.8 05.7		65.7 05.8		66.7 05.8		67.7 05.9		68.7 06.0		69.7 06.1		70.7 06.2		71.7 06.3		72.7 06.3		73.7 06.3		22
22	64.6 06.8		65.6 06.9		66.6 07.0		67.6 07.1		68.6 07.2		69.6 07.3		70.6 07.4		71.6 07.5		72.6 07.5		73.6 07.5		23
23	64.5 07.9		65.5 08.0		66.5 08.2		67.5 08.3		68.5 08.4		69.5 08.5		70.5 08.7		71.5 08.8		72.5 08.8		73.5 08.8		24
24	64.4 09.0		65.4 09.2		66.3 09.3		67.3 09.5		68.3 09.6		69.3 09.7		70.3 09.9		71.3 10.0		72.3 10.0		73.3 10.0		25
25	64.2 10.2		65.2 10.3		66.2 10.5		67.2 10.6		68.2 10.8		69.1 11.0		70.1 11.1		71.1 11.3		72.1 11.3		73.1 11.3		26
26	64.0 11.3		65.0 11.5		66.0 11.6		67.0 11.8		68.0 12.0		68.9 12.2		69.9 12.3		70.9 12.5		71.9 12.5		72.9 12.5		27
27	63.8 12.4		64.8 12.6		65.8 12.8		66.8 13.0		67.7 13.2		68.7 13.4		69.7 13.5		70.7 13.7		71.7 13.7		72.7 13.7		28
28	63.6 13.5		64.6 13.7		65.5 13.9		66.5 14.1		67.5 14.3		68.5 14.6		69.4 14.8		70.4 15.0		71.4 15.0		72.4 15.0		29
29	63.3 14.6		64.3 14.8		65.3 15.1		66.3 15.3		67.2 15.5		68.2 15.7		69.2 16.0		70.2 16.2		71.2 16.2		72.2 16.2		30
30	63.1 15.7		64.0 16.0		65.0 16.2		66.0 16.5		67.0 16.7		67.9 16.9		68.9 17.2		69.9 17.4		70.9 17.4		71.9 17.4		31
31	62.8 16.8		63.8 17.1		64.7 17.3		65.7 17.6		66.6 17.9		67.6 18.1		68.6 18.4		69.6 18.6		70.6 18.6		71.6 18.6		32
32	62.5 17.9		63.4 18.2		64.4 18.5		65.4 18.7		66.3 19.0		67.3 19.3		68.2 19.6		69.2 19.8		70.2 19.8		71.2 19.8		33
33	62.2 19.0		63.1 19.3		64.1 19.6		65.0 19.9		66.0 20.2		66.9 20.5		67.9 20.8		68.9 21.1		69.9 21.1		70.9 21.1		34
34	61.8 20.1		62.8 20.4		63.7 20.7		64.7 21.0		65.6 21.3		66.6 21.6		67.5 21.9		68.5 22.2		69.5 22.2		70.5 22.2		35
35	61.5 21.2		62.4 21.5		63.3 21.8		64.3 22.1		65.2 22.5		66.2 22.8		67.1 23.1		68.1 23.4		69.1 23.4		70.1 23.4		36
36	61.1 22.2		62.0 22.6		63.0 22.9		63.9 23.3		64.8 23.6		65.8 23.9		66.7 24.3		67.7 24.6		68.7 24.6		69.7 24.6		37
37	60.7 23.3		61.6 23.7		62.5 24.0		63.5 24.4		64.4 24.7		65.4 25.1		66.3 25.4		67.2 25.8		68.2 25.8		69.2 25.8		38
38	60.3 24.3		61.2 24.7		62.1 25.1		63.0 25.5		64.0 25.8		64.9 26.2		65.8 26.6		66.8 27.0		67.8 27.0		68.8 27.0		39
39	59.8 25.4		60.8 25.8		61.7 26.2		62.6 26.6		63.5 27.0		64.4 27.4		65.4 27.7		66.3 28.1		67.3 28.1		68.3 28.1		40
40	59.4 26.4		60.3 26.8		61.2 27.3		62.1 27.7		63.0 28.1		63.9 28.5		64.9 28.9		65.8 29.3		66.8 29.3		67.8 29.3		41
41	58.9 27.5		59.8 27.9		60.7 28.3		61.6 28.7		62.5 29.2		63.4 29.6		64.3 30.0		65.3 30.4		66.3 30.4		67.3 30.4		42
42	58.4 28.5		59.3 28.9		60.2 29.3		61.1 29.8		62.0 30.2		62.9 30.7		63.8 31.1		64.7 31.6		65.7 31.6		66.7 31.6		43
43	57.9 29.5		58.8 30.0		59.7 30.4		60.6 30.9		61.5 31.3		62.4 31.8		63.3 32.2		64.2 32.7		65.2 32.7		66.2 32.7		44
44	57.4 30.5		58.3 31.0		59.2 31.5		60.0 31.9		60.9 32.4		61.8 32.9		62.7 33.3		63.6 33.8		64.6 33.8		65.6 33.8		45
45	56.9 31.5		57.7 32.0		58.6 32.5		59.5 33.0		60.3 33.5		61.2 33.9		62.1 34.4		63.0 34.9		64.0 34.9		65.0 34.9		46
46	56.3 32.5		57.2 33.0		58.0 33.5		58.9 34.0		59.8 34.5		60.6 35.0		61.5 35.5		62.4 36.0		63.4 36.0		64.4 36.0		47
47	55.7 33.5		56.6 34.0		57.4 34.5		58.3 35.0		59.1 35.5		60.0 36.0		60.9 36.6		61.7 37.1		62.7 37.1		63.7 37.1		48
48	55.1 34.4		56.0 35.0		56.8 35.5		57.7 36.0		58.5 36.6		59.4 37.1		60.2 37.6		61.1 38.2		62.1 38.2		63.1 38.2		49
49	54.5 35.4		55.4 35.9		56.2 36.5		57.0 37.0		57.9 37.6		58.7 38.1		59.5 38.7		60.4 39.2		61.4 39.2		62.4 39.2		50
50	53.9 36.3		54.7 36.9		55.5 37.5		56.4 38.0		57.2 38.6		58.0 39.1		58.9 39.7		59.7 40.3		60.7 40.3		61.7 40.3		51
51	53.2 37.3		54.1 37.9		54.9 38.4		55.7 39.0		56.5 39.6		57.3 40.2		58.2 40.7		59.0 41.3		60.0 41.3		61.0 41.3		52
52	52.6 38.2		53.4 38.8		54.2 39.4		55.0 40.0		55.8 40.6		56.6 41.1		57.4 41.7		58.2 42.3		59.2 42.3		60.2 42.3		53
53	51.9 39.1		52.7 39.7		53.5 40.3		54.3 40.9		55.1 41.5		55.9 42.1		56.7 42.7		57.5 43.3		58.5 43.3		59.5 43.3		54
54	51.2 40.0		52.0 40.6		52.8 41.2		53.6 41.9		54.4 42.5		55.2 43.1		55.9 43.7		56.7 44.3		57.7 44.3		58.7 44.3		55
55	50.5 40.9		51.3 41.5		52.1 42.2		52.8 42.8		53.6 43.4		54.4 44.1		55.2 44.7		56.0 45.3		57.0 45.3		58.0 45.3		56
56	49.8 41.8		50.6 42.4		51.3 43.1		52.1 43.7		52.9 44.4		53.6 45.0		54.4 45.6		55.2 46.3		56.2 46.3		57.2 46.3		57
57	49.1 42.6		49.8 43.3		50.6 44.0		51.3 44.6		52.1 45.3		52.8 45.9		53.6 46.6		54.3 47.2		55.3 47.2		56.3 47.2		58
58	48.3 43.5		49.0 44.2		49.8 44.8		50.5 45.5		51.3 46.2		52.0 46.8		52.8 47.5		53.5 48.2		54.5 48.2		55.5 48.2		59
59	47.5 44.3		48.3 45.0		49.0 45.7		49.7 46.4		50.5 47.1		51.2 47.7		51.9 48.4		52.7 49.1		53.7 49.1		54.7 49.1		60
60	46.8 45.2		47.5 45.8		48.2 46.5	</															

Traverse Table.

(x.)

Distance. 73			74		75		76		77		78		79		80		
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse.
1	72.9 03.6		73.9 03.6		74.9 03.7		75.9 03.7		76.9 03.8		77.9 03.8		78.9 03.9		79.9 03.9		7
2	72.6 07.2		73.6 07.3		74.6 07.4		75.6 07.4		76.6 07.5		77.6 07.6		78.6 07.7		79.6 07.8		8
3	72.2 10.7		73.2 10.9		74.2 11.0		75.2 11.1		76.2 11.3		77.2 11.4		78.1 11.6		79.1 11.7		9
4	71.6 14.2		72.6 14.4		73.6 14.6		74.5 14.8		75.5 15.0		76.5 15.2		77.5 15.4		78.5 15.6		10
5	70.8 17.7		71.8 18.0		72.8 18.2		73.7 18.5		74.7 18.7		75.7 19.0		76.6 19.2		77.6 19.4		11
6	69.9 21.2		70.8 21.5		71.8 21.8		72.7 22.1		73.7 22.3		74.6 22.6		75.6 22.9		76.6 23.2		12
7	68.7 24.6		69.7 24.9		70.6 25.3		71.6 25.6		72.5 25.9		73.4 26.3		74.4 26.6		75.3 26.9		13
8	67.4 27.9		68.4 28.3		69.3 28.7		70.2 29.1		71.1 29.5		72.1 29.9		73.0 30.2		73.9 30.6		14
9	66.0 31.2		66.9 31.6		67.8 32.1		68.7 32.5		69.6 32.9		70.5 33.4		71.4 33.8		72.3 34.2		15
10	64.4 34.4		65.3 34.9		66.1 35.4		67.0 35.8		67.9 36.3		68.8 36.8		69.7 37.2		70.6 37.7		16
11	62.6 37.5		63.5 38.0		64.3 38.6		65.2 39.1		66.0 39.6		66.9 40.1		67.8 40.6		68.6 41.1		17
12	60.7 40.6		61.5 41.1		62.4 41.7		63.2 42.2		64.0 42.8		64.8 43.3		65.7 43.9		66.5 44.4		18
13	58.6 43.5		59.4 44.1		60.2 44.7		61.0 45.3		61.8 45.9		62.6 46.5		63.4 47.1		64.3 47.7		19
14	56.4 46.3		57.2 46.9		58.0 47.6		58.7 48.2		59.5 48.8		60.3 49.5		61.1 50.1		61.8 50.7		20
15	54.1 49.0		54.8 49.7		55.6 50.4		56.3 51.0		57.0 51.7		57.8 52.4		58.5 53.0		59.3 53.7		21
16	51.6 51.6		52.3 52.3		53.0 53.0		53.7 53.7		54.4 54.4		55.2 55.2		55.9 55.9		56.6 56.6		22
17	73.0 01.3		74.0 01.3		75.0 01.3		76.0 01.3		77.0 01.3		78.0 01.4		79.0 01.4		80.0 01.4		23
18	73.0 02.5		74.0 02.6		75.0 02.6		76.0 02.7		77.0 02.7		78.0 02.7		79.0 02.8		80.0 02.8		24
19	72.9 03.8		73.9 03.9		74.9 03.9		75.9 04.0		76.9 04.0		77.9 04.1		78.9 04.1		79.9 04.2		25
20	72.8 05.1		73.8 05.2		74.8 05.2		75.8 05.3		76.8 05.4		77.8 05.4		78.8 05.5		79.8 05.6		26
21	72.7 06.4		73.7 06.4		74.7 06.5		75.7 06.6		76.7 06.7		77.7 06.8		78.7 06.9		79.7 07.0		27
22	72.6 07.6		73.6 07.7		74.6 07.8		75.6 07.9		76.6 08.0		77.6 08.1		78.6 08.3		79.6 08.4		28
23	72.5 08.9		73.4 09.0		74.4 09.1		75.4 09.3		76.4 09.4		77.4 09.5		78.4 09.6		79.4 09.7		29
24	72.3 10.2		73.3 10.3		74.3 10.4		75.3 10.6		76.3 10.7		77.2 10.9		78.2 11.0		79.2 11.1		30
25	72.1 11.4		73.1 11.6		74.1 11.7		75.1 11.9		76.1 12.0		77.0 12.2		78.0 12.4		79.0 12.5		31
26	71.9 12.7		72.9 12.8		73.9 13.0		74.8 13.2		75.8 13.4		76.8 13.5		77.8 13.7		78.8 13.9		32
27	71.7 13.9		72.6 14.1		73.6 14.3		74.6 14.5		75.6 14.7		76.6 14.9		77.5 15.1		78.5 15.3		33
28	71.4 15.2		72.4 15.4		73.4 15.6		74.3 15.8		75.3 16.0		76.3 16.2		77.3 16.4		78.3 16.6		34
29	71.1 16.4		72.1 16.6		73.1 16.9		74.1 17.1		75.0 17.3		76.0 17.5		77.0 17.8		77.9 18.0		35
30	70.8 17.7		71.8 17.9		72.8 18.1		73.7 18.4		74.7 18.6		75.7 18.9		76.7 19.1		77.6 19.4		36
31	70.5 18.9		71.5 19.2		72.4 19.4		73.4 19.7		74.4 19.9		75.3 20.2		76.3 20.4		77.3 20.7		37
32	70.2 20.1		71.1 20.4		72.1 20.7		73.1 20.9		74.0 21.2		75.0 21.5		75.9 21.8		76.9 22.1		38
33	69.8 21.3		70.8 21.6		71.7 21.9		72.7 22.2		73.6 22.5		74.6 22.8		75.5 23.1		76.5 23.4		39
34	69.4 22.6		70.4 22.9		71.3 23.2		72.3 23.5		73.2 23.8		74.2 24.1		75.1 24.4		76.1 24.7		40
35	69.0 23.8		70.0 24.1		70.9 24.4		71.9 24.7		72.8 25.1		73.8 25.4		74.7 25.7		75.6 26.0		41
36	68.6 25.0		69.5 25.3		70.5 25.7		71.4 26.0		72.4 26.3		73.3 26.7		74.2 27.0		75.2 27.4		42
37	68.2 26.2		69.1 26.5		70.0 26.9		71.0 27.2		71.9 27.6		72.8 28.0		73.8 28.3		74.7 28.7		43
38	67.7 27.3		68.6 27.7		69.5 28.1		70.5 28.5		71.4 28.8		72.3 29.2		73.2 29.6		74.2 30.0		44
39	67.2 28.5		68.1 28.9		69.0 29.3		70.0 29.7		70.9 30.1		71.8 30.5		72.7 30.9		73.6 31.3		45
40	66.7 29.7		67.6 30.1		68.5 30.5		69.4 30.9		70.3 31.3		71.3 31.7		72.2 32.1		73.1 32.5		46
41	66.2 30.9		67.1 31.3		68.0 31.7		68.9 32.1		69.8 32.5		70.7 33.0		71.6 33.4		72.5 33.8		47
42	65.6 32.0		66.5 32.4		67.4 32.9		68.3 33.3		69.2 33.8		70.1 34.2		71.0 34.6		71.9 35.1		48
43	65.0 33.1		65.9 33.6		66.8 34.0		67.7 34.5		68.6 35.0		69.5 35.4		70.4 35.9		71.3 36.3		49
44	64.5 34.3		65.3 34.7		66.2 35.2		67.1 35.7		68.0 36.1		68.9 36.6		69.8 37.1		70.6 37.6		50
45	63.8 35.4		64.7 35.9		65.6 36.4		66.5 36.8		67.3 37.3		68.2 37.8		69.1 38.3		70.0 38.8		51
46	63.2 36.5		64.1 37.0		65.0 37.5		65.8 38.0		66.7 38.5		67.5 39.0		68.4 39.5		69.3 40.0		52
47	62.6 37.6		63.4 38.1		64.3 38.6		65.1 39.1		66.0 39.7		66.9 40.2		67.7 40.7		68.6 41.2		53
48	61.9 38.7		62.8 39.2		63.6 39.7		64.5 40.3		65.3 40.8		66.1 41.3		67.0 41.9		67.8 42.4		54
49	61.2 39.8		62.1 40.3		62.9 40.8		63.7 41.4		64.6 41.9		65.4 42.5		66.3 43.0		67.1 43.6		55
50	60.5 40.8		61.3 41.4		62.2 41.9		63.0 42.5		63.8 43.1		64.7 43.6		65.5 44.2		66.3 44.7		56
51	59.8 41.9		60.6 42.4		61.4 43.0		62.3 43.6		63.1 44.2		63.9 44.7		64.7 45.3		65.5 45.9		57
52	59.1 42.9		59.9 43.5		60.7 44.1		61.5 44.7		62.3 45.3		63.1 45.8		63.9 46.4		64.7 47.0		58
53	58.3 43.9		59.1 44.5		59.9 45.1		60.7 45.7		61.5 46.3		62.3 46.9		63.1 47.5		63.9 48.1		59
54	57.5 44.9		58.3 45.6		59.1 46.2		59.9 46.8		60.7 47.4		61.5 48.0		62.3 48.6		63.0 49.3		60
55	56.7 45.9		57.5 46.6		58.3 47.2		59.1 47.8		59.8 48.5		60.6 49.1		61.4 49.7		62.2 50.3		61
56	55.9 46.9		56.7 47.6		57.5 48.2		58.2 48.9		59.0 49.5		59.8 50.1		60.5 50.8		61.3 51.4		62
57	55.1 47.9		55.8 48.5		56.6 49.2		57.4 49.9		58.1 50.5		58.9 51.2		59.6 51.8		60.4 52.5		63
58	54.2 48.8		55.0 49.5		55.7 50.2		56.5 50.9		57.2 51.5		58.0 52.2		58.7 52.9		59.5 53.5		64
59	53.4 49.8		54.1 50.5		54.9 51.1		55.6 51.8		56.3 52.5		57.0 53.2		57.8 53.9		58.5 54.6		65
60	52.5 50.7		53.2 51.4		54.0 52.1		54.7 52.8		55.4 53.5		56.1 54.2		56.8 54.9		57.5 55.6		66
61	51.6 51.6		52.3 52.3		53.0 53.0		53.7 53.7		54.4 54.4		55.2 55.2		55.9 55.9		56.6 56.6		67
Crse.	Dep. | Diff. Lat.		Dep. | Diff. Lat.		Dep. | Diff. Lat.		Dep. | Diff. Lat.		Dep. | Diff. Lat.		Dep. | Diff. Lat.		Dep. | Diff. Lat.		Dep. | Diff. Lat.		Crse.

Traverse Table.

(x)

Distance. 81		82		83		84		85		86		87		88	
Crs.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crs.
1	80.9 04.0	81.9 04.0	82.9 04.1	83.9 04.1	84.9 04.2	85.9 04.2	86.9 04.3	87.9 04.3	88.9 04.3	89.9 04.3	90.9 04.3	91.9 04.3	92.9 04.3	93.9 04.3	94.9 04.3
2	80.6 07.9	81.6 08.0	82.6 08.1	83.6 08.2	84.6 08.3	85.6 08.4	86.6 08.5	87.6 08.6	88.6 08.6	89.6 08.6	90.6 08.6	91.6 08.6	92.6 08.6	93.6 08.6	94.6 08.6
3	80.1 11.9	81.1 12.0	82.1 12.2	83.1 12.3	84.1 12.5	85.1 12.6	86.1 12.8	87.1 12.9	88.1 12.9	89.1 12.9	90.1 12.9	91.1 12.9	92.1 12.9	93.1 12.9	94.1 12.9
4	79.4 15.8	80.4 16.0	81.4 16.2	82.4 16.4	83.4 16.6	84.3 16.8	85.3 17.0	86.3 17.2	87.3 17.2	88.3 17.2	89.3 17.2	90.3 17.2	91.3 17.2	92.3 17.2	93.3 17.2
5	78.6 19.7	79.5 19.9	80.5 20.2	81.5 20.4	82.5 20.7	83.4 20.9	84.4 21.1	85.4 21.4	86.4 21.4	87.4 21.4	88.4 21.4	89.4 21.4	90.4 21.4	91.4 21.4	92.4 21.4
6	77.5 23.5	78.5 23.8	79.4 24.1	80.4 24.4	81.3 24.7	82.3 25.0	83.3 25.2	84.3 25.5	85.3 25.5	86.3 25.5	87.3 25.5	88.3 25.5	89.3 25.5	90.3 25.5	91.3 25.5
7	76.3 27.3	77.2 27.6	78.1 28.0	79.1 28.3	80.0 28.6	81.0 29.0	81.9 29.3	82.9 29.6	83.9 29.6	84.9 29.6	85.9 29.6	86.9 29.6	87.9 29.6	88.9 29.6	89.9 29.6
8	74.8 31.0	75.8 31.4	76.7 31.8	77.6 32.1	78.5 32.5	79.5 32.9	80.4 33.3	81.3 33.7	82.3 33.7	83.3 33.7	84.3 33.7	85.3 33.7	86.3 33.7	87.3 33.7	88.3 33.7
9	73.2 34.6	74.1 35.1	75.0 35.5	75.9 35.9	76.8 36.3	77.7 36.8	78.6 37.2	79.6 37.6	80.6 37.6	81.6 37.6	82.6 37.6	83.6 37.6	84.6 37.6	85.6 37.6	86.6 37.6
10	71.4 38.2	72.3 38.6	73.2 39.1	74.1 39.6	75.0 40.1	75.9 40.5	76.8 41.0	77.8 41.4	78.8 41.4	79.8 41.4	80.8 41.4	81.8 41.4	82.8 41.4	83.8 41.4	84.8 41.4
11	69.5 41.6	70.3 42.2	71.2 42.7	72.0 43.2	72.9 43.7	73.8 44.2	74.6 44.7	75.5 45.2	76.5 45.2	77.5 45.2	78.5 45.2	79.5 45.2	80.5 45.2	81.5 45.2	82.5 45.2
12	67.3 45.0	68.2 45.6	69.0 46.1	69.8 46.7	70.7 47.2	71.5 47.8	72.3 48.3	73.2 48.9	74.2 48.9	75.2 48.9	76.2 48.9	77.2 48.9	78.2 48.9	79.2 48.9	80.2 48.9
13	65.1 48.3	65.9 48.9	66.7 49.4	67.5 50.0	68.3 50.6	69.1 51.2	69.9 51.8	70.7 52.4	71.7 52.4	72.7 52.4	73.7 52.4	74.7 52.4	75.7 52.4	76.7 52.4	77.7 52.4
14	62.6 51.4	63.4 52.0	64.2 52.7	64.9 53.3	65.7 53.9	66.5 54.6	67.2 55.2	68.0 55.8	69.0 55.8	70.0 55.8	71.0 55.8	72.0 55.8	73.0 55.8	74.0 55.8	75.0 55.8
15	60.0 54.4	60.8 55.1	61.5 55.7	62.2 56.4	63.0 57.1	63.7 57.7	64.5 58.4	65.2 59.1	66.2 59.1	67.2 59.1	68.2 59.1	69.2 59.1	70.2 59.1	71.2 59.1	72.2 59.1
16	57.3 57.3	58.0 58.0	58.7 58.7	59.4 59.4	60.1 60.1	60.8 60.8	61.5 61.5	62.2 62.2	63.0 62.2	63.7 62.2	64.5 62.2	65.2 62.2	66.0 62.2	66.7 62.2	67.5 62.2
17	81.0 01.4	82.0 01.4	83.0 01.4	84.0 01.5	85.0 01.5	86.0 01.5	87.0 01.5	88.0 01.5	89.0 01.5	90.0 01.5	91.0 01.5	92.0 01.5	93.0 01.5	94.0 01.5	95.0 01.5
18	81.0 02.8	82.0 02.9	83.0 02.9	83.9 02.9	84.9 03.0	85.9 03.0	86.9 03.0	87.9 03.1	88.9 03.1	89.9 03.1	90.9 03.1	91.9 03.1	92.9 03.1	93.9 03.1	94.9 03.1
19	80.9 04.2	81.9 04.3	82.9 04.3	83.9 04.4	84.9 04.4	85.9 04.5	86.9 04.6	87.9 04.6	88.9 04.6	89.9 04.6	90.9 04.6	91.9 04.6	92.9 04.6	93.9 04.6	94.9 04.6
20	80.8 05.7	81.8 05.7	82.8 05.8	83.8 05.9	84.8 05.9	85.8 06.0	86.8 06.1	87.8 06.1	88.8 06.1	89.8 06.1	90.8 06.1	91.8 06.1	92.8 06.1	93.8 06.1	94.8 06.1
21	80.7 07.1	81.7 07.1	82.7 07.2	83.7 07.3	84.7 07.4	85.7 07.5	86.7 07.6	87.7 07.7	88.7 07.7	89.7 07.7	90.7 07.7	91.7 07.7	92.7 07.7	93.7 07.7	94.7 07.7
22	80.6 08.5	81.6 08.6	82.5 08.7	83.5 08.8	84.5 08.9	85.5 09.0	86.5 09.1	87.5 09.2	88.5 09.2	89.5 09.2	90.5 09.2	91.5 09.2	92.5 09.2	93.5 09.2	94.5 09.2
23	80.4 09.9	81.4 10.0	82.4 10.1	83.4 10.2	84.4 10.4	85.4 10.5	86.4 10.6	87.4 10.7	88.4 10.7	89.4 10.7	90.4 10.7	91.4 10.7	92.4 10.7	93.4 10.7	94.4 10.7
24	80.2 11.3	81.2 11.4	82.2 11.6	83.2 11.7	84.2 11.8	85.2 12.0	86.2 12.1	87.1 12.2	88.1 12.2	89.1 12.2	90.1 12.2	91.1 12.2	92.1 12.2	93.1 12.2	94.1 12.2
25	80.0 12.7	81.0 12.8	82.0 13.0	83.0 13.1	84.0 13.3	84.9 13.5	85.9 13.6	86.9 13.8	87.9 13.8	88.9 13.8	89.9 13.8	90.9 13.8	91.9 13.8	92.9 13.8	93.9 13.8
26	79.8 14.1	80.8 14.2	81.7 14.4	82.7 14.6	83.7 14.8	84.7 14.9	85.7 15.1	86.7 15.3	87.7 15.3	88.7 15.3	89.7 15.3	90.7 15.3	91.7 15.3	92.7 15.3	93.7 15.3
27	79.5 15.5	80.5 15.6	81.5 15.8	82.5 16.0	83.4 16.2	84.4 16.4	85.4 16.6	86.4 16.8	87.4 16.8	88.4 16.8	89.4 16.8	90.4 16.8	91.4 16.8	92.4 16.8	93.4 16.8
28	79.2 16.8	80.2 17.0	81.2 17.3	82.2 17.5	83.1 17.7	84.1 17.9	85.1 18.1	86.1 18.3	87.1 18.3	88.1 18.3	89.1 18.3	90.1 18.3	91.1 18.3	92.1 18.3	93.1 18.3
29	78.9 18.2	79.9 18.4	80.9 18.7	81.8 18.9	82.8 19.1	83.8 19.3	84.8 19.6	85.7 19.8	86.7 19.8	87.7 19.8	88.7 19.8	89.7 19.8	90.7 19.8	91.7 19.8	92.7 19.8
30	78.6 19.6	79.6 19.8	80.5 20.1	81.5 20.3	82.5 20.6	83.4 20.8	84.4 21.0	85.4 21.3	86.4 21.3	87.4 21.3	88.4 21.3	89.4 21.3	90.4 21.3	91.4 21.3	92.4 21.3
31	78.2 21.0	79.2 21.2	80.2 21.5	81.1 21.7	82.1 22.0	83.1 22.3	84.0 22.5	85.0 22.8	86.0 22.8	87.0 22.8	88.0 22.8	89.0 22.8	90.0 22.8	91.0 22.8	92.0 22.8
32	77.9 22.3	78.8 22.6	79.8 22.9	80.7 23.2	81.7 23.4	82.7 23.7	83.6 24.0	84.6 24.3	85.6 24.3	86.6 24.3	87.6 24.3	88.6 24.3	89.6 24.3	90.6 24.3	91.6 24.3
33	77.5 23.7	78.4 24.0	79.4 24.3	80.3 24.6	81.3 24.9	82.2 25.1	83.2 25.4	84.2 25.7	85.2 25.7	86.2 25.7	87.2 25.7	88.2 25.7	89.2 25.7	90.2 25.7	91.2 25.7
34	77.0 25.0	78.0 25.3	79.0 25.6	80.0 25.9	80.8 26.3	81.8 26.6	82.7 26.9	83.7 27.2	84.7 27.2	85.7 27.2	86.7 27.2	87.7 27.2	88.7 27.2	89.7 27.2	90.7 27.2
35	76.6 26.4	77.5 26.7	78.5 27.0	79.4 27.3	80.4 27.7	81.3 28.0	82.3 28.3	83.2 28.7	84.2 28.7	85.2 28.7	86.2 28.7	87.2 28.7	88.2 28.7	89.2 28.7	90.2 28.7
36	76.1 27.7	77.1 28.0	78.0 28.4	78.9 28.7	79.9 29.1	80.8 29.4	81.8 29.8	82.7 30.1	83.7 30.1	84.7 30.1	85.7 30.1	86.7 30.1	87.7 30.1	88.7 30.1	89.7 30.1
37	75.6 29.0	76.6 29.4	77.5 29.7	78.4 30.1	79.4 30.5	80.3 30.8	81.2 31.2	82.2 31.5	83.2 31.5	84.2 31.5	85.2 31.5	86.2 31.5	87.2 31.5	88.2 31.5	89.2 31.5
38	75.1 30.3	76.0 30.7	77.0 31.1	77.9 31.5	78.8 31.8	79.7 32.2	80.7 32.6	81.6 33.0	82.6 33.0	83.6 33.0	84.6 33.0	85.6 33.0	86.6 33.0	87.6 33.0	88.6 33.0
39	74.6 31.6	75.5 32.0	76.4 32.4	77.3 32.8	78.2 33.2	79.2 33.6	80.1 34.0	81.0 34.4	82.0 34.4	83.0 34.4	84.0 34.4	85.0 34.4	86.0 34.4	87.0 34.4	88.0 34.4
40	74.0 32.9	74.9 33.4	75.8 33.8	76.7 34.2	77.7 34.6	78.6 35.0	79.5 35.4	80.4 35.8	81.4 35.8	82.4 35.8	83.4 35.8	84.4 35.8	85.4 35.8	86.4 35.8	87.4 35.8
41	73.4 34.2	74.3 34.7	75.2 35.1	76.1 35.5	77.0 35.9	77.9 36.3	78.8 36.8	79.8 37.2	80.8 37.2	81.8 37.2	82.8 37.2	83.8 37.2	84.8 37.2	85.8 37.2	86.8 37.2
42	72.8 35.5	73.7 35.9	74.6 36.4	75.5 36.8	76.4 37.3	77.3 37.7	78.2 38.1	79.1 38.6	80.1 38.6	81.1 38.6	82.1 38.6	83.1 38.6	84.1 38.6	85.1 38.6	86.1 38.6
43	72.2 36.8	73.1 37.2	74.0 37.7	74.8 38.1	75.7 38.6	76.6 39.0	77.5 39.5	78.4 40.0	79.4 40.0	80.4 40.0	81.4 40.0	82.4 40.0	83.4 40.0	84.4 40.0	85.4 40.0
44	71.5 38.0	72.4 38.5	73.3 39.0	74.2 39.4	75.1 39.9	75.9 40.4	76.8 40.8	77.7 41.3	78.7 41.3	79.7 41.3	80.7 41.3	81.7 41.3	82.7 41.3	83.7 41.3	84.7 41.3
45	70.8 39.3	71.7 39.8	72.6 40.2	73.5 40.7	74.3 41.2	75.2 41.7	76.1 42.2	77.0 42.7	78.0 42.7	79.0 42.7	80.0 42.7	81.0 42.7	82.0 42.7	83.0 42.7	84.0 42.7
46	70.1 40.5	71.0 41.0	71.9 41.5	72.7 42.0	73.6 42.5	74.5 43.0	75.3 43.5	76.2 44.0	77.2 44.0	78.2 44.0	79.2 44.0	80.2 44.0	81.2 44.0	82.2 44.0	83.2 44.0
47	69.4 41.7	70.3 42.2	71.1 42.7	72.0 43.3	72.9 43.8	73.7 44.3	74.6 44.8	75.4 45.3	76.4 45.3	77.4 45.3	78.4 45.3	79.4 45.3	80.4 45.3	81.4 45.3	82.4 45.3
48	68.7 42.9	69.5 43.5	70.4 44.0	71.2 44.5	72.1 45.0	72.9 45.6	73.8 46.1	74.6 46.6	75.6 46.6	76.6 46.6	77.6 46.6	78.6 46.6	79.6 46.6	80.6 46.6	81.6 46.6
49	67.9 44.1	68.8 44.7	69.6 45.2	70.4 45.7	71.3 46.3	72.1 46.8	73.0 47.4	73.8 47.9	74.8 47.9	75.8 47.9	76.8 47.9	77.8 47.9	78.8 47.9	79.8 47.9	80.8 47.9
50	67.2 45.3	68.0 45.9	68.8 46.4	69.6 47.0	70.5 47.5	71.3 48.1	72.1 48.6	73.0 49.2	74.0 49.2	75.0 49.2	76.0 49.2	77.0 49.2	78.0 49.2	79.0 49.2	80.0 49.2
51	66.4 46.5	67.2 47.0	68.0 47.6	68.8 48.2	69.6 48.8	70.4 49.3	71.3 49.9	72.1 50.5	73.1 50.5	74.1 50.5	75.1 50.5	76.1 50.5	77.1 50.5	78.1 50.5	79.1 50.5
52	65.5 47.6	66.3 48.2	67.1 48.8	68.0 49.4	68.8 50.0	69.6 50.5	70.4 51.1	71.2 51.7	72.2 51.7	73.2 51.7	74.2 51.7	75.2 51.7	76.2 51.7	77.2 51.7	78.2 51.7
53	64.7 48.7	65.5 49.3	66.3 50.0	67.1 50.6	67.9 51.2	68.7 51.8	69.5 52.4	70.3 53.0	71.3 53.0	72.3 53.0	73.3 53.0	74.3 53.0	75.3 53.0	76.3 53.0	77.3 53.0
54	63.8 49.9	64.6 50.5	65.4 51.1	66.2 51.7	6										

Traverse Table.

(x.)

Distance. 89		90		91		92		93		94		95		96		Crs.	
Crs.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.		
1	88.9 04.4 88.6 08.7 88.0 13.1	89.9 04.4 89.6 08.8 89.0 13.2	90.9 04.5 90.6 08.9 90.0 13.3	91.9 04.5 91.6 09.0 91.0 13.5	92.9 04.6 92.6 09.1 92.0 13.6	93.9 04.6 93.5 09.2 93.0 13.8	94.9 04.7 94.5 09.3 94.0 13.9	95.9 04.7 95.5 09.4 95.0 14.1	96.9 04.7 96.5 09.4 96.0 14.1	97.9 04.7 97.5 09.4 97.0 14.1	98.9 04.7 98.5 09.4 98.0 14.1	99.9 04.7 99.5 09.4 99.0 14.1	100.9 04.7 100.5 09.4 100.0 14.1	101.9 04.7 101.5 09.4 101.0 14.1	102.9 04.7 102.5 09.4 102.0 14.1	7	
2	87.3 17.4 86.3 21.6 85.2 25.8 83.8 30.0	88.3 17.6 87.3 21.9 86.1 26.1 84.7 30.3	89.2 17.8 88.3 22.1 87.1 26.4 85.7 30.7	90.2 18.0 89.2 22.4 88.0 26.7 86.6 31.0	91.2 18.1 90.2 22.6 89.0 27.0 87.6 31.3	92.2 18.3 91.2 22.8 90.0 27.3 88.5 31.7	93.2 18.3 92.2 23.1 90.9 27.6 89.4 32.0	94.2 18.5 93.2 23.1 91.9 27.9 90.4 32.3	95.2 18.5 94.2 23.1 92.9 27.9 91.4 32.3	96.2 18.5 95.2 23.1 93.9 27.9 92.4 32.3	97.2 18.5 96.2 23.1 94.9 27.9 93.4 32.3	98.2 18.5 97.2 23.1 95.9 27.9 94.4 32.3	99.2 18.5 98.2 23.1 96.9 27.9 95.4 32.3	100.2 18.5 99.2 23.1 97.9 27.9 96.4 32.3	101.2 18.5 100.2 23.1 98.9 27.9 97.4 32.3	6	
3	80.5 38.1 78.5 41.9 76.3 45.7	81.4 38.5 79.4 42.4 77.2 46.3	82.3 38.9 80.3 42.9 78.1 46.8	83.2 39.3 81.1 43.4 78.9 47.3	84.1 39.8 82.0 43.8 79.8 47.8	85.0 40.2 82.9 44.3 80.6 48.3	85.9 40.6 83.8 44.8 81.5 48.8	86.8 41.1 84.7 45.2 82.3 49.3	87.7 41.1 85.6 45.2 83.1 49.3	88.6 41.1 86.5 45.2 83.9 49.3	89.5 41.1 87.4 45.2 84.7 49.3	90.4 41.1 88.3 45.2 85.5 49.3	91.3 41.1 89.2 45.2 86.3 49.3	92.2 41.1 90.1 45.2 87.1 49.3	93.1 41.1 91.0 45.2 88.0 49.3	5	
4	74.0 49.4 71.5 53.0 68.8 56.5 65.9 59.8	74.8 50.0 72.3 53.6 69.6 57.1 66.7 60.4	75.7 50.6 73.1 54.2 70.3 57.7 67.4 61.1	76.5 51.1 73.9 54.8 71.1 58.4 68.2 61.8	77.3 51.7 74.7 55.4 71.9 59.0 68.9 62.4	78.2 52.2 75.5 56.0 72.7 59.6 69.6 63.1	79.0 52.8 76.3 56.6 73.4 60.3 70.4 63.8	79.8 53.3 77.1 57.2 74.2 60.9 71.1 64.5	80.6 53.3 77.9 57.2 74.9 60.9 71.8 64.5	81.4 53.3 78.7 57.2 75.6 60.9 72.5 64.5	82.2 53.3 79.5 57.2 76.3 60.9 73.2 64.5	83.0 53.3 80.3 57.2 77.1 60.9 74.0 64.5	83.8 53.3 81.1 57.2 77.9 60.9 74.8 64.5	84.6 53.3 81.9 57.2 78.7 60.9 75.6 64.5	85.4 53.3 82.7 57.2 79.5 60.9 76.4 64.5	86.2 53.3 83.5 57.2 80.3 60.9 77.2 64.5	4
10	89.0 01.6 88.9 03.1 88.9 04.7 88.8 06.2	90.0 01.6 89.9 03.1 89.9 04.7 89.8 06.3	91.0 01.6 90.9 03.2 90.9 04.8 90.8 06.3	92.0 01.6 91.9 03.2 91.9 04.8 91.8 06.4	93.0 01.6 92.9 03.2 92.9 04.9 92.8 06.5	94.0 01.6 93.9 03.3 93.9 04.9 93.8 06.6	95.0 01.7 94.9 03.3 94.9 05.0 94.8 06.6	96.0 01.7 95.9 03.4 95.9 05.0 95.8 06.7	97.0 01.7 96.9 03.4 96.9 05.0 96.8 06.7	98.0 01.7 97.9 03.4 97.9 05.0 97.8 06.7	99.0 01.7 98.9 03.4 98.9 05.0 98.8 06.7	100.0 01.7 99.9 03.4 99.9 05.0 99.8 06.7	101.0 01.7 100.9 03.4 100.9 05.0 100.8 06.7	102.0 01.7 101.9 03.4 101.9 05.0 101.8 06.7	103.0 01.7 102.9 03.4 102.9 05.0 102.8 06.7	89°	
2	88.9 03.1 88.9 04.7 88.8 06.2 88.7 07.8	89.9 03.1 89.9 04.7 89.8 06.3 89.7 07.8	90.9 03.2 90.9 04.8 90.8 06.3 90.7 07.9	91.9 03.2 91.9 04.8 91.8 06.4 91.6 08.0	92.9 03.2 92.9 04.9 92.8 06.5 92.6 08.1	93.9 03.3 93.9 04.9 93.8 06.6 93.6 08.2	94.9 03.3 94.9 05.0 94.8 06.6 94.6 08.3	95.9 03.4 95.9 05.0 95.8 06.7 95.6 08.4	96.9 03.4 96.9 05.0 96.8 06.7 96.6 08.4	97.9 03.4 97.9 05.0 97.8 06.7 97.6 08.4	98.9 03.4 98.9 05.0 98.8 06.7 98.6 08.4	99.9 03.4 99.9 05.0 99.8 06.7 99.6 08.4	100.9 03.4 100.9 05.0 100.8 06.7 100.6 08.4	101.9 03.4 101.9 05.0 101.8 06.7 101.6 08.4	102.9 03.4 102.9 05.0 102.8 06.7 102.6 08.4	88	
3	88.9 04.7 88.8 06.2 88.7 07.8 88.5 09.3	89.9 04.7 89.8 06.3 89.7 07.8 89.5 09.4	90.9 04.8 90.8 06.3 90.7 07.9 90.5 09.5	91.9 04.8 91.8 06.4 91.6 08.0 91.5 09.6	92.9 04.9 92.8 06.5 92.6 08.1 92.5 09.7	93.9 04.9 93.8 06.6 93.6 08.2 93.5 09.8	94.9 05.0 94.8 06.6 94.6 08.3 94.5 09.9	95.9 05.0 95.8 06.7 95.6 08.4 95.5 10.0	96.9 05.0 96.8 06.7 96.6 08.4 96.5 10.0	97.9 05.0 97.8 06.7 97.6 08.4 97.5 10.0	98.9 05.0 98.8 06.7 98.6 08.4 98.5 10.0	99.9 05.0 99.8 06.7 99.6 08.4 99.5 10.0	100.9 05.0 100.8 06.7 100.6 08.4 100.5 10.0	101.9 05.0 101.8 06.7 101.6 08.4 101.5 10.0	102.9 05.0 102.8 06.7 102.6 08.4 102.5 10.0	87	
4	88.9 06.2 88.7 07.8 88.5 09.3 88.3 10.8	89.8 06.3 89.7 07.8 89.5 09.4 89.3 11.0	90.8 06.3 90.7 07.9 90.5 09.5 90.3 11.1	91.8 06.4 91.6 08.0 91.5 09.6 91.3 11.2	92.8 06.5 92.6 08.1 92.5 09.7 92.3 11.3	93.8 06.6 93.6 08.2 93.5 09.8 93.3 11.5	94.8 06.6 94.6 08.3 94.5 09.9 94.3 11.6	95.8 06.7 95.6 08.4 95.5 10.0 95.3 11.7	96.8 06.7 96.6 08.4 96.5 10.0 96.3 11.7	97.8 06.7 97.6 08.4 97.5 10.0 97.3 11.7	98.8 06.7 98.6 08.4 98.5 10.0 98.3 11.7	99.8 06.7 99.6 08.4 99.5 10.0 99.3 11.7	100.8 06.7 100.6 08.4 100.5 10.0 100.3 11.7	101.8 06.7 101.6 08.4 101.5 10.0 101.3 11.7	102.8 06.7 102.6 08.4 102.5 10.0 102.3 11.7	86	
5	88.9 07.8 88.7 09.3 88.5 10.8 88.3 12.4	89.7 07.8 89.5 09.4 89.3 11.0 89.1 12.5	90.7 07.9 90.5 09.5 90.3 11.1 90.1 12.7	91.6 08.0 91.5 09.6 91.3 11.2 91.1 12.8	92.6 08.1 92.5 09.7 92.3 11.3 92.1 12.9	93.6 08.2 93.5 09.8 93.3 11.5 93.1 13.1	94.6 08.3 94.5 09.9 94.3 11.6 94.1 13.2	95.6 08.4 95.5 10.0 95.3 11.7 95.1 13.4	96.6 08.4 96.5 10.0 96.3 11.7 96.1 13.4	97.6 08.4 97.5 10.0 97.3 11.7 97.1 13.4	98.6 08.4 98.5 10.0 98.3 11.7 98.1 13.4	99.6 08.4 99.5 10.0 99.3 11.7 99.1 13.4	100.6 08.4 100.5 10.0 100.3 11.7 100.1 13.4	101.6 08.4 101.5 10.0 101.3 11.7 101.1 13.4	102.6 08.4 102.5 10.0 102.3 11.7 102.1 13.4	85	
6	88.9 09.3 88.7 10.8 88.5 12.4 88.3 14.0	89.5 09.4 89.3 11.0 89.1 12.5 88.9 14.1	90.5 09.5 90.3 11.1 90.1 12.7 89.9 14.2	91.5 09.6 91.3 11.2 91.1 12.8 90.9 14.4	92.5 09.7 92.3 11.3 92.1 12.9 91.9 14.5	93.5 09.8 93.3 11.5 93.1 13.1 92.8 14.7	94.5 09.9 94.3 11.6 94.1 13.2 93.8 14.9	95.5 10.0 95.3 11.7 95.1 13.4 94.8 15.0	96.5 10.0 96.3 11.7 96.1 13.4 95.8 15.0	97.5 10.0 97.3 11.7 97.1 13.4 96.8 15.0	98.5 10.0 98.3 11.7 98.1 13.4 97.8 15.0	99.5 10.0 99.3 11.7 99.1 13.4 99.0 15.0	100.5 10.0 100.3 11.7 100.1 13.4 100.0 15.0	101.5 10.0 101.3 11.7 101.1 13.4 101.0 15.0	102.5 10.0 102.3 11.7 102.1 13.4 102.0 15.0	84	
7	88.9 10.8 88.7 12.4 88.5 14.0 88.3 15.6	89.3 11.0 89.1 12.5 88.9 14.1 88.6 15.6	90.3 11.1 90.1 12.7 89.9 14.2 89.6 15.8	91.3 11.2 91.1 12.8 90.9 14.4 90.6 16.0	92.3 11.3 92.1 12.9 91.9 14.5 91.6 16.1	93.3 11.5 93.1 13.1 92.8 14.7 92.6 16.3	94.3 11.6 94.1 13.2 93.8 14.9 93.6 16.5	95.3 11.7 95.1 13.4 94.8 15.0 94.5 16.7	96.3 11.7 96.1 13.4 95.8 15.0 95.5 16.7	97.3 11.7 97.1 13.4 96.8 15.0 96.5 16.7	98.3 11.7 98.1 13.4 97.8 15.0 97.5 16.7	99.3 11.7 99.1 13.4 98.8 15.0 98.5 16.7	100.3 11.7 100.1 13.4 99.8 15.0 99.5 16.7	101.3 11.7 101.1 13.4 100.8 15.0 100.5 16.7	102.3 11.7 102.1 13.4 101.8 15.0 101.5 16.7	83	
8	88.9 12.4 88.7 14.0 88.5 15.6 88.3 17.2	89.1 12.5 88.9 14.1 88.6 15.6 88.3 17.2	90.1 12.7 89.9 14.2 89.6 15.8 89.3 17.4	91.1 12.8 90.9 14.4 90.6 16.0 90.3 17.6	92.1 12.9 91.9 14.5 91.6 16.1 91.3 17.7	93.1 13.1 92.8 14.7 92.6 16.3 92.3 17.9	94.1 13.2 93.8 14.9 93.6 16.5 93.3 18.1	95.1 13.4 94.8 15.0 94.5 16.7 94.2 18.3	96.1 13.4 95.8 15.0 95.5 16.7 95.2 18.3	97.1 13.4 96.8 15.0 96.5 16.7 96.2 18.3	98.1 13.4 97.8 15.0 97.5 16.7 97.2 18.3	99.1 13.4 98.8 15.0 98.5 16.7 98.2 18.3	100.1 13.4 99.8 15.0 99.5 16.7 99.2 18.3	101.1 13.4 100.8 15.0 100.5 16.7 100.2 18.3	102.1 13.4 101.8 15.0 101.5 16.7 101.2 18.3	82	
9	88.9 14.0 88.7 15.6 88.5 17.2 88.3 18.8	88.9 14.1 88.6 15.6 88.3 17.2 88.0 18.7	89.9 14.2 89.6 15.8 89.3 17.4 89.0 18.9	90.9 14.4 90.6 16.0 90.3 17.6 90.0 19.1	91.9 14.5 91.6 16.1 91.3 17.7 91.0 19.3	92.8 14.7 92.6 16.3 92.3 17.9 91.9 19.5	93.8 14.9 93.6 16.5 93.3 18.1 92.9 19.8	94.8 15.0 94.5 16.7 94.2 18.3 93.9 20.0	95.8 15.0 95.5 16.7 95.2 18.3 94.9 20.0	96.8 15.0 96.5 16.7 96.2 18.3 95.9 20.0	97.8 15.0 97.5 16.7 97.2 18.3 96.9 20.0	98.8 15.0 98.5 16.7 98.2 18.3 97.9 20.0	99.8 15.0 99.5 16.7 99.2 18.3 98.9 20.0	100.8 15.0 100.5 16.7 100.2 18.3 99.9 20.0	101.8 15.0 101.5 16.7 101.2 18.3 100.9 20.0	81	
10	88.9 15.6 88.7 17.2 88.5 18.8 88.3 20.4	88.6 15.6 88.3 17.2 88.0 18.7 87.7 20.2	89.6 15.8 89.3 17.4 89.0 18.9 88.7 20.5	90.6 16.0 90.3 17.6 90.0 19.1 89.6 20.7	91.6 16.1 91.3 17.7 91.0 19.3 90.6 20.9	92.6 16.3 92.3 17.9 91.9 19.5 91.6 21.1	93.6 16.5 93.3 18.1 92.9 19.8 92.6 21.4	94.6 16.7 94.2 18.3 93.9 20.0 93.5 21.6	95.6 16.7 95.2 18.3 94.9 20.0 94.5 21.6	96.6 16.7 96.2 18.3 95.9 20.0 95.5 21.6	97.6 16.7 97.2 18.3 96.9 20.0 96.5 21.6	98.6 16.7 98.2 18.3 97.9 20.0 97.5 21.6	99.6 16.7 99.2 18.3 98.9 20.0 98.5 21.6	100.6 16.7 100.2 18.3 99.9 20.0 99.5 21.6	101.6 16.7 101.2 18.3 100.9 20.0 100.5 21.6	80	
11	88.9 17.2 88.7 18.8 88.5 20.4 88.3 22.0	88.3 17.2 88.0 18.7 87.7 20.2 87.4 21.6	89.3 17.4 89.0 18.9 88.7 20.5 88.3 22.0	90.3 17.6 90.0 19.1 89.6 20.7 89.3 22.3	91.3 17.7 91.0 19.3 90.6 20.9 90.2 22.5	92.3 17.9 91.9 19.5 91.6 21.1 91.2 22.7	93.3 18.1 92.9 19.8 92.6 21.4 92.2 23.0	94.3 18.3 93.9 20.0 93.5 21.6 93.1 23.2	95.3 18.3 94.9 20.0 94.5 21.6 94.1 23.2	96.3 18.3 95.9 20.0 95.5 21.6 95.1 23.2	97.3 18.3 96.9 20.0 96.5 21.6 96.1 23.2	98.3 18.3 97.9 20.0 97.5 21.6 97.1 23.2	99.3 18.3 98.9 20.0 98.5 21.6 98.1 23.2	100.3 18.3 100.0 20.0 99.6 21.6 99.2 23.2	101.3 18.3 101.0 20.0 100.6 21.6 100.2 23.2	79	
12	88.9 18.8 88.7 20.4 88.5 22.0 88.3 23.6	88.0 18.7 87.7 20.2 87.4 21.6 87.1 23.0	89.0 18.9 88.7 20.5 88.3 22.0 87.9 23.6	90.0 19.1 89.6 20.7 89.3 22.3 88.9 23.8	91.0 19.3 90.6 20.9 90.2 22.5 89.8 24.1	91.9 19.5 91.6 21.1 91.2 22.7 90.8 24.3	92.9 19.8 92.6 21.4 92.2 23.0 91.8 24.6	93.9 20.0 93.5 21.6 93.1 23.2 92.7 24.8	94.9 20.0 94.5 21.6 94.1 23.2 93.7 25.0	95.9 20.0 95.5 21.6 95.1 23.2 94.7 25.0	96.9 20.0 96.5 21.6 96.1 23.2 95.7 25.0	97.9 20.0 97.5 21.6 97.1 23.2 96.7 25.0	98.9 20.0 98.5 21.6 98.1 23.2 97.7 25.0	99.9 20.0 99.5 21.6 99.1 23.2 98.7 25.0	100.9 20.0 100.5 21.6 100.1 23.2 99.7 25.0	78	
13	88.9 20.4 88.7 22.0 88.5 23.6 88.3 25.2	87.7 20.2 87.4 21.6 87.1 23.0 86.8 24.4	88.7 20.5 88.3 22.0 87.9 23.6 87.5 25.1	89.6 20.7 89.3 22.3 88.9 23.8 88.4 25.4	90.6 20.9 90.2 22.5 89.8 24.1 89.4 25.6	91.6 21.1 91.2 22.7 90.8 24.3 90.4 25.9	92.6 21.4 92.2 23.0 91.8 24.6 91.3 26.2	93.6 21.6 93.1 23.2 92.7 24.8 92.3 26.5	94.6 21.6 94.1 23.2 93.7 25.0								

Traverse Table.

(x.)

Distance. 97			98			99			100			101			102			103			104		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.		
1	96.9	04.8	97.9	04.8	98.9	04.9	99.9	04.9	100.9	05.0	101.9	05.0	102.9	05.1	103.9	05.1	104.9	05.1	105.9	05.1	106.9		
2	96.6	09.5	97.5	09.6	98.5	09.7	99.5	09.8	100.5	09.9	101.5	10.0	102.5	10.1	103.5	10.2	104.5	10.3	105.5	10.3	106.5		
3	95.9	14.2	96.9	14.4	97.9	14.5	98.9	14.7	99.9	14.8	100.9	15.0	101.9	15.1	102.9	15.3	103.9	15.4	104.9	15.5	105.9		
4	95.1	18.9	96.1	19.1	97.1	19.3	98.1	19.5	99.1	19.7	100.0	19.9	101.0	20.1	102.0	20.3	103.0	20.4	104.0	20.5	105.0		
5	94.1	23.6	95.1	23.8	96.0	24.1	97.0	24.3	98.0	24.5	98.9	24.8	99.9	25.0	100.9	25.3	101.9	25.4	102.9	25.5	103.9		
6	92.8	28.2	93.8	28.4	94.7	28.7	95.7	29.0	96.7	29.3	97.6	29.6	98.6	29.9	99.5	30.2	100.5	30.3	101.5	30.4	102.5		
7	91.3	32.7	92.3	33.0	93.2	33.3	94.2	33.7	95.1	34.0	96.0	34.4	97.0	34.7	97.9	35.0	98.9	35.1	99.9	35.2	100.9		
8	89.6	37.1	90.5	37.5	91.5	37.9	92.4	38.3	93.3	38.7	94.2	39.0	95.2	39.4	96.1	39.8	97.1	40.1	98.1	40.2	99.1		
9	87.7	41.5	88.6	41.9	89.5	42.3	90.4	42.8	91.3	43.2	92.2	43.6	93.1	44.0	94.0	44.5	94.9	44.9	95.9	45.0	96.9		
10	85.6	45.7	86.4	46.2	87.3	46.7	88.2	47.1	89.1	47.6	90.0	48.1	90.8	48.5	91.7	49.0	92.6	49.4	93.5	49.5	94.5		
11	83.2	49.9	84.1	50.4	84.9	50.9	85.8	51.4	86.6	51.9	87.5	52.4	88.3	52.9	89.2	53.5	90.1	53.9	91.0	54.0	92.0		
12	80.6	53.9	81.5	54.4	82.3	55.0	83.1	55.6	84.0	56.1	84.8	56.7	85.6	57.2	86.5	57.8	87.4	58.2	88.3	58.3	89.3		
13	77.9	57.8	78.7	58.4	79.5	59.0	80.3	59.6	81.1	60.2	81.9	60.8	82.7	61.4	83.5	62.0	84.4	62.4	85.3	62.5	86.3		
14	75.0	61.5	75.7	62.2	76.5	62.8	77.3	63.4	78.1	64.1	78.8	64.7	79.6	65.3	80.4	65.9	81.3	66.3	82.2	66.4	83.2		
15	71.9	65.1	72.6	65.8	73.3	66.5	74.1	67.2	74.8	67.8	75.6	68.5	76.3	69.2	77.1	69.8	78.0	70.4	79.9	70.5	80.4		
16	68.6	68.6	69.3	69.3	70.0	70.0	70.7	70.7	71.4	71.4	72.1	72.1	72.8	72.8	73.5	73.5	74.2	74.2	74.9	74.9	75.6		
17	97.0	01.7	98.0	01.7	99.0	01.7	100.0	01.7	101.0	01.8	102.0	01.8	103.0	01.8	104.0	01.8	105.0	01.8	106.0	01.8	107.0		
18	96.9	03.4	97.9	03.4	98.9	03.5	99.9	03.5	100.9	03.5	101.9	03.6	102.9	03.6	103.9	03.6	104.9	03.6	105.9	03.6	106.9		
19	96.9	05.1	97.9	05.1	98.9	05.2	99.9	05.2	100.9	05.3	101.9	05.3	102.9	05.4	103.9	05.4	104.9	05.4	105.9	05.4	106.9		
20	96.8	06.8	97.8	06.8	98.8	06.9	99.8	07.0	100.8	07.0	101.8	07.1	102.7	07.2	103.7	07.3	104.7	07.3	105.7	07.3	106.7		
21	96.6	08.5	97.6	08.5	98.6	08.6	99.6	08.7	100.6	08.8	101.6	08.9	102.6	09.0	103.6	09.1	104.6	09.1	105.6	09.1	106.6		
22	96.5	10.1	97.5	10.2	98.5	10.3	99.5	10.5	100.4	10.6	101.4	10.7	102.4	10.8	103.4	10.9	104.4	10.9	105.4	10.9	106.4		
23	96.3	11.8	97.3	11.9	98.3	12.1	99.3	12.2	100.2	12.3	101.2	12.4	102.2	12.6	103.2	12.7	104.2	12.7	105.2	12.7	106.2		
24	96.1	13.5	97.0	13.6	98.0	13.8	99.0	13.9	100.0	14.1	101.0	14.2	102.0	14.3	103.0	14.5	104.0	14.5	105.0	14.5	106.0		
25	95.8	15.2	96.8	15.3	97.8	15.5	98.8	15.6	99.8	15.8	100.7	16.0	101.7	16.1	102.7	16.3	103.7	16.3	104.7	16.3	105.7		
26	95.5	16.8	96.5	17.0	97.5	17.2	98.5	17.4	99.5	17.5	100.5	17.7	101.4	17.9	102.4	18.1	103.4	18.1	104.4	18.1	105.4		
27	95.2	18.5	96.2	18.7	97.2	18.9	98.2	19.1	99.1	19.3	100.1	19.5	101.1	19.7	102.1	19.8	103.1	19.8	104.1	19.8	105.1		
28	94.9	20.2	95.9	20.4	96.8	20.6	97.8	20.8	98.8	21.0	99.8	21.2	100.7	21.4	101.7	21.6	102.7	21.6	103.7	21.6	104.7		
29	94.5	21.8	95.5	22.0	96.5	22.3	97.4	22.5	98.4	22.7	99.4	22.9	100.4	23.2	101.3	23.4	102.3	23.4	103.3	23.4	104.3		
30	94.1	23.5	95.1	23.7	96.1	24.0	97.0	24.2	98.0	24.4	99.0	24.7	99.9	24.9	100.9	25.2	101.8	25.2	102.8	25.2	103.8		
31	93.7	25.1	94.7	25.4	95.6	25.6	96.6	25.9	97.6	26.1	98.5	26.4	99.5	26.7	100.5	26.9	101.5	26.9	102.5	26.9	103.5		
32	93.2	26.7	94.2	27.0	95.2	27.3	96.1	27.6	97.1	27.8	98.0	28.1	99.0	28.4	100.0	28.7	101.0	28.7	102.0	28.7	103.0		
33	92.8	28.4	93.7	28.7	94.7	28.9	95.6	29.2	96.6	29.5	97.5	29.8	98.5	30.1	99.5	30.4	100.5	30.4	101.5	30.4	102.5		
34	92.3	30.0	93.2	30.3	94.2	30.6	95.1	30.9	96.1	31.2	97.0	31.5	98.0	31.8	98.9	32.1	99.9	32.1	100.9	32.1	101.9		
35	91.7	31.6	92.7	31.9	93.6	32.2	94.6	32.6	95.5	32.9	96.4	33.2	97.4	33.5	98.3	33.9	99.3	33.9	100.3	33.9	101.3		
36	91.2	33.2	92.1	33.5	93.0	33.9	94.0	34.2	94.9	34.5	95.8	34.9	96.8	35.2	97.7	35.6	98.7	35.6	99.7	35.6	100.7		
37	90.6	34.8	91.5	35.1	92.4	35.5	93.4	35.8	94.3	36.2	95.2	36.6	96.2	36.9	97.1	37.3	98.1	37.3	99.1	37.3	100.1		
38	89.9	36.3	90.9	36.7	91.8	37.1	92.7	37.5	93.6	37.8	94.6	38.2	95.5	38.6	96.4	39.0	97.3	39.0	98.3	39.0	99.3		
39	89.3	37.9	90.2	38.3	91.1	38.7	92.1	39.1	93.0	39.5	93.9	39.9	94.8	40.2	95.7	40.6	96.7	40.6	97.7	40.6	98.7		
40	88.6	39.5	89.5	39.9	90.4	40.3	91.4	40.7	92.3	41.1	93.2	41.5	94.1	41.9	95.0	42.3	96.1	42.3	97.1	42.3	98.1		
41	87.9	41.0	88.8	41.4	89.7	41.8	90.6	42.3	91.5	42.7	92.4	43.1	93.3	43.5	94.3	44.0	95.4	44.0	96.2	44.0	97.2		
42	87.2	42.5	88.1	43.0	89.0	43.4	89.9	43.8	90.8	44.3	91.7	44.7	92.6	45.2	93.5	45.6	94.4	45.6	95.4	45.6	96.4		
43	86.4	44.0	87.3	44.5	88.2	44.9	89.1	45.4	90.0	45.9	90.9	46.3	91.8	46.8	92.7	47.2	93.6	47.2	94.5	47.2	95.5		
44	85.6	45.5	86.5	46.0	87.4	46.5	88.3	46.9	89.2	47.4	90.1	47.9	90.9	48.4	91.8	48.8	92.7	48.8	93.6	48.8	94.5		
45	84.8	47.0	85.7	47.5	86.6	48.0	87.5	48.5	88.3	49.0	89.2	49.5	90.1	49.9	91.0	50.4	92.0	49.9	93.0	49.9	94.0		
46	84.0	48.5	84.9	49.0	85.7	49.5	86.6	50.0	87.5	50.5	88.3	51.0	89.2	51.5	90.1	52.0	91.0	51.5	92.0	51.5	93.0		
47	83.1	50.0	84.0	50.5	84.9	51.0	85.7	51.5	86.6	52.0	87.4	52.5	88.3	53.0	89.1	53.6	90.1	52.5	91.0	52.5	92.0		
48	82.3	51.4	83.1	51.9	84.0	52.5	84.8	53.0	85.7	53.5	86.5	54.1	87.3	54.6	88.2	55.1	89.1	54.1	90.0	54.1	91.0		
49	81.4	52.8	82.2	53.4	83.0	53.9	83.9	54.5	84.7	55.0	85.5	55.6	86.4	56.1	87.2	56.6	88.1	55.6	89.0	55.6	90.0		
50	80.4	54.2	81.2	54.8	82.1	55.4	82.9	55.9	83.7	56.5	84.6	57.0	85.4	57.6	86.2	58.2	87.1	57.6	88.0	57.6	89.0		
51	79.5	55.6	80.3	56.2	81.1	56.8	81.9	57.4	82.7	57.9	83.6	58.5	84.4	59.1	85.2	59.7	86.1	58.5	87.0	58.5	89.0		
52	78.5	57.0	79.3	57.6	80.1	58.2	80.9	58.8	81.7	59.4	82.5	60.0	83.3	60.5	84.1	61.1	85.1	60.0	86.0	60.0	88.0		
53	77.5	58.4	78.3	59.0	79.1	59.6	79.9	60.2	80.7	60.8	81.5	61.4	82.3	62.0	83.1	62.6	84.1	61.4	85.0	61.4	87.0		
54	76.4	59.7	77.2	60.3	78.0	6																	

Traverse Table.

(x.)

Distance. 105			106			107			108			109			110			111			112		
Cross	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Cross		
1	104.9	05.2	105.9	05.2	106.9	05.3	107.9	05.3	108.9	05.4	109.9	05.4	110.9	05.5	111.9	05.5	112.9	05.5	113.9	05.5	7		
2	104.5	10.3	105.5	10.3	106.5	10.5	107.5	10.6	108.5	10.7	109.5	10.8	110.5	10.8	111.5	10.8	112.5	10.8	113.5	10.8	8		
3	103.9	15.4	104.8	15.5	105.8	15.7	106.8	15.8	107.8	16.0	108.8	16.1	109.8	16.3	110.8	16.4	111.8	16.4	112.8	16.4	9		
4	103.0	20.5	104.0	20.7	104.9	20.9	105.9	21.1	106.9	21.3	107.9	21.5	108.9	21.7	109.8	21.9	110.8	21.9	111.8	21.9	10		
5	101.9	25.5	102.8	25.8	103.8	26.0	104.8	26.2	105.7	26.5	106.7	26.7	107.7	27.0	108.6	27.2	109.6	27.2	110.6	27.2	11		
6	100.5	30.5	101.4	30.8	102.4	31.1	103.4	31.4	104.3	31.6	105.3	31.9	106.2	32.2	107.2	32.5	108.2	32.5	109.2	32.5	12		
7	98.9	35.4	99.8	35.7	100.7	36.0	101.7	36.4	102.6	36.7	103.6	37.1	104.5	37.4	105.4	37.7	106.4	37.7	107.4	37.7	13		
8	97.0	40.2	97.9	40.6	98.9	41.0	99.8	41.3	100.7	41.7	101.6	42.1	102.6	42.5	103.5	42.9	104.5	42.9	105.5	42.9	14		
9	94.9	44.9	95.8	45.3	96.7	45.8	97.6	46.2	98.5	46.6	99.4	47.0	100.3	47.5	101.2	47.9	102.2	47.9	103.2	47.9	15		
10	92.6	49.5	93.5	50.0	94.4	50.4	95.3	50.9	96.1	51.4	97.0	51.8	97.9	52.3	98.8	52.8	99.8	52.8	100.8	52.8	16		
11	90.1	54.0	90.9	54.5	91.8	55.0	92.6	55.5	93.5	56.0	94.3	56.5	95.2	57.1	96.1	57.6	97.1	57.6	98.1	57.6	17		
12	87.3	58.3	88.1	58.9	89.0	59.4	89.8	60.0	90.6	60.6	91.5	61.1	92.3	61.7	93.1	62.2	94.1	62.2	95.1	62.2	18		
13	84.3	62.6	85.1	63.1	85.9	63.7	86.7	64.3	87.5	64.9	88.4	65.5	89.2	66.1	90.0	66.7	91.0	66.7	92.0	66.7	19		
14	81.2	66.6	81.9	67.2	82.7	67.9	83.5	68.5	84.3	69.1	85.0	69.8	85.8	70.4	86.6	71.0	87.6	71.0	88.6	71.0	20		
15	77.8	70.5	78.5	71.2	79.3	71.8	80.0	72.5	80.8	73.2	81.5	73.9	82.2	74.5	83.0	75.2	84.0	75.2	85.0	75.2	21		
16	74.2	74.2	75.0	75.0	75.7	75.7	76.4	76.4	77.1	77.1	77.8	77.8	78.5	78.5	79.2	79.2	79.9	79.2	80.0	79.2	22		
17	105.0	01.8	106.0	01.8	107.0	01.9	108.0	01.9	109.0	01.9	110.0	01.9	111.0	01.9	112.0	02.0	113.0	02.0	114.0	02.0	23		
18	104.9	03.7	105.9	03.7	106.9	03.7	107.9	03.8	108.9	03.8	109.9	03.8	110.9	03.9	111.9	03.9	112.9	03.9	113.9	03.9	24		
19	104.9	05.5	105.9	05.5	106.9	05.6	107.9	05.7	108.9	05.7	109.8	05.8	110.8	05.8	111.8	05.9	112.8	05.9	113.8	05.9	25		
20	104.7	07.3	105.7	07.4	106.7	07.5	107.7	07.5	108.7	07.6	109.7	07.7	110.7	07.7	111.7	07.8	112.7	07.8	113.7	07.8	26		
21	104.6	09.2	105.6	09.2	106.6	09.3	107.6	09.4	108.6	09.5	109.6	09.6	110.6	09.7	111.6	09.8	112.6	09.8	113.6	09.8	27		
22	104.4	11.0	105.4	11.1	106.4	11.2	107.4	11.3	108.4	11.4	109.4	11.5	110.4	11.6	111.4	11.7	112.4	11.7	113.4	11.7	28		
23	104.2	12.8	105.2	12.9	106.2	13.0	107.2	13.2	108.2	13.3	109.2	13.4	110.2	13.5	111.2	13.6	112.2	13.6	113.2	13.6	29		
24	104.0	14.6	105.0	14.8	106.0	14.9	106.9	15.0	107.9	15.2	108.9	15.3	109.9	15.4	110.9	15.6	111.9	15.6	112.9	15.6	30		
25	103.7	16.4	104.7	16.6	105.7	16.7	106.7	16.9	107.7	17.1	108.6	17.2	109.6	17.4	110.6	17.5	111.6	17.5	112.6	17.5	31		
26	103.4	18.2	104.4	18.4	105.4	18.6	106.4	18.8	107.3	18.9	108.3	19.1	109.3	19.3	110.3	19.4	111.3	19.4	112.3	19.4	32		
27	103.1	20.0	104.1	20.2	105.0	20.4	106.0	20.6	107.0	20.8	108.0	21.0	109.0	21.2	109.9	21.4	110.9	21.4	111.9	21.4	33		
28	102.7	21.8	103.7	22.0	104.7	22.2	105.6	22.5	106.6	22.7	107.6	22.9	108.6	23.1	109.6	23.3	110.6	23.3	111.6	23.3	34		
29	102.3	23.6	103.3	23.8	104.3	24.1	105.2	24.3	106.2	24.5	107.2	24.7	108.2	25.0	109.1	25.2	110.1	25.2	111.1	25.2	35		
30	101.9	25.4	102.9	25.6	103.8	25.9	104.8	26.1	105.8	26.4	106.7	26.6	107.7	26.9	108.7	27.1	109.7	27.1	110.7	27.1	36		
31	101.4	27.2	102.4	27.4	103.4	27.7	104.3	28.0	105.3	28.2	106.3	28.5	107.2	28.7	108.2	29.0	109.2	29.0	110.2	29.0	37		
32	100.9	28.9	101.9	29.2	102.9	29.5	103.8	29.8	104.8	30.0	105.7	30.3	106.7	30.6	107.7	30.9	108.7	30.9	109.7	30.9	38		
33	100.4	30.7	101.4	31.0	102.3	31.3	103.3	31.6	104.2	31.9	105.2	32.2	106.1	32.5	107.1	32.7	108.1	32.7	109.1	32.7	39		
34	99.9	32.4	100.8	32.8	101.8	33.1	102.7	33.4	103.7	33.7	104.6	34.0	105.6	34.3	106.5	34.6	107.5	34.6	108.5	34.6	40		
35	99.3	34.2	100.2	34.5	101.2	34.8	102.1	35.2	103.1	35.5	104.0	35.8	105.0	36.1	105.9	36.5	107.1	36.5	108.1	36.5	41		
36	98.7	35.9	99.6	36.3	100.5	36.6	101.5	36.9	102.4	37.3	103.4	37.6	104.3	38.0	105.2	38.3	106.2	38.3	107.2	38.3	42		
37	98.0	37.6	99.0	38.0	99.9	38.3	100.8	38.7	101.8	39.1	102.7	39.4	103.6	39.8	104.6	40.1	105.6	40.1	106.6	40.1	43		
38	97.4	39.3	98.3	39.7	99.2	40.1	100.1	40.5	101.1	40.8	102.0	41.2	102.9	41.6	103.8	42.0	104.8	42.0	105.8	42.0	44		
39	96.7	41.0	97.6	41.4	98.5	41.8	99.4	42.2	100.3	42.6	101.3	43.0	102.2	43.4	103.1	43.8	104.1	43.8	105.1	43.8	45		
40	95.9	42.7	96.8	43.1	97.7	43.5	98.7	43.9	99.6	44.3	100.5	44.7	101.4	45.1	102.3	45.6	103.2	45.6	104.2	45.6	46		
41	95.2	44.4	96.1	44.8	97.0	45.2	97.9	45.6	98.8	46.1	99.7	46.5	100.6	46.9	101.5	47.3	102.5	47.3	103.5	47.3	47		
42	94.4	46.0	95.3	46.5	96.2	46.9	97.1	47.3	98.0	47.8	98.9	48.2	99.8	48.7	100.7	49.1	101.7	49.1	102.7	49.1	48		
43	93.6	47.7	94.4	48.1	95.3	48.6	96.2	49.0	97.1	49.5	98.0	49.9	98.9	50.4	99.8	50.8	100.8	50.8	101.8	50.8	49		
44	92.7	49.3	93.6	49.8	94.5	50.2	95.4	50.7	96.2	51.2	97.1	51.6	98.0	52.1	98.9	52.6	99.8	52.6	100.8	52.6	50		
45	91.8	50.9	92.7	51.4	93.6	51.9	94.5	52.4	95.3	52.8	96.2	53.3	97.1	53.8	98.0	54.3	99.0	54.3	100.0	54.3	51		
46	90.9	52.5	91.8	53.0	92.7	53.5	93.5	54.0	94.4	54.5	95.3	55.0	96.1	55.5	97.0	56.0	98.0	56.0	99.0	56.0	52		
47	90.0	54.1	90.9	54.6	91.7	55.1	92.6	55.6	93.4	56.1	94.3	56.7	95.1	57.2	96.0	57.7	97.9	57.7	98.9	57.7	53		
48	89.0	55.6	89.9	56.2	90.7	56.7	91.6	57.2	92.4	57.8	93.3	58.3	94.1	58.8	95.0	59.4	96.8	59.4	97.8	59.4	54		
49	88.1	57.2	88.9	57.7	89.7	58.3	90.6	58.8	91.4	59.4	92.3	59.9	93.1	60.5	93.9	61.0	95.7	61.0	96.7	61.0	55		
50	87.0	58.7	87.9	59.3	88.7	59.8	89.5	60.4	90.4	61.0	91.2	61.5	92.0	62.1	92.9	62.6	96.6	62.6	98.3	62.6	56		
51	86.0	60.2	86.8	60.8	87.6	61.4	88.5	61.9	89.3	62.5	90.1	63.1	90.9	63.7	91.7	64.2	95.5	64.2	97.2	64.2	57		
52	84.9	61.7	85.8	62.3	86.6	62.9	87.4	63.5	88.2	64.1	89.0	64.7	89.8	65.2	90.6	65.8	94.4	65.8	96.1	65.8	58		
53	83.9	63.2	84.7	63.8	85.5	64.4	86.3	65.0	87.1	65.6	87.8	66.2	88.6	66.8	89.4	67.4	93.2	67.4	94.9	67.4	59		
54	82.7	64.6	83.5	65.3	84.3	65.9	85.1	66.5	85.9	67.1	86.7	67.7	87.5	68.3	88.3	69.0	92.0	69.0	93.7	69.0	60		
55	81.6	66.1	82.4	66.7	83.2	67.3	83.9	68.0	84.7	68.6	85.5	69.2	86.3	69.9	87.0	70.5	91.1	70.5	92.8	70.5	61		
56	80.4	67.5	81.2	68.1	82.0	68.8	82.7	69.4	83.5	70.1	84.3	70.7	85.0	71.3	85.8	72.0	90.0	72.0	91.7	72.0	62		
57	79.2	68.9	80.0	69.5	80.8	70.2	81.5	70.9	82.3	71.5	83.0	72.2	83.8	72.8	84.5	73.5	89.0	73.5	90.7	73.5	63		
58	78.0	70.3	78.8	70.9	79.5	71.6	80.3	72.3	81.0	72.9	81.7	73.6	82.5	74.3	83.2	74.9	88.0	74.9	89.7	74.9	64		
59	76.8	71.6	77.5	72.3	78.3	73.0	79.0	73.7	79.7	74.3	80.4	75.0	81.2	75.7	81.9	76.4	87.0	76.4	88.7	76.4	65		
60	75.5	72.9	76.3	73.6	77.0	74.3	77.7	75.0	78.4	75.7	79.1	76.4	79.8	77.1	80.6	77.8							

Traverse Table.

(X.)

Distance. 113			114			115			116			117			118			119			120			Crs.
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.			
1	112.9	05.5	113.9	05.6	114.9	05.6	115.9	05.7	116.9	05.7	117.9	05.8	118.9	05.8	119.9	05.9	120.9	05.9	121.9	05.9	7			
	112.5	11.1	113.5	11.2	114.4	11.3	115.4	11.4	116.4	11.5	117.4	11.6	118.4	11.7	119.4	11.8	120.4	11.8	121.4	11.8	7			
	111.8	16.6	112.8	16.7	113.7	16.9	114.7	17.0	115.7	17.2	116.7	17.3	117.7	17.5	118.7	17.6	119.7	17.6	120.7	17.6	7			
	110.8	22.0	111.8	22.2	112.8	22.4	113.8	22.6	114.7	22.8	115.7	23.0	116.7	23.2	117.7	23.4	118.7	23.4	119.7	23.4	7			
2	109.6	27.5	110.6	27.7	111.6	27.9	112.5	28.2	113.5	28.4	114.5	28.7	115.4	28.9	116.4	29.2	117.4	29.2	118.4	29.2	6			
	108.1	32.8	109.1	33.1	110.1	33.4	111.0	33.7	112.0	34.0	112.9	34.2	113.9	34.5	114.8	34.8	115.8	34.8	116.8	34.8	6			
	106.4	38.1	107.3	38.4	108.3	38.7	109.2	39.1	110.2	39.4	111.1	39.7	112.0	40.1	113.0	40.4	114.0	40.4	115.0	40.4	6			
	104.4	43.2	105.3	43.6	106.3	44.0	107.2	44.4	108.1	44.8	109.0	45.2	109.9	45.5	110.9	45.9	111.8	45.9	112.8	45.9	6			
3	102.1	48.3	103.1	48.7	104.0	49.2	104.9	49.6	105.8	50.0	106.7	50.5	107.6	50.9	108.5	51.3	109.5	51.3	110.5	51.3	5			
	99.7	53.3	100.5	53.7	101.4	54.2	102.3	54.7	103.2	55.1	104.1	55.6	105.0	56.1	105.8	56.6	106.8	56.6	107.8	56.6	5			
	96.9	58.1	97.8	58.6	98.6	59.1	99.5	59.6	100.4	60.1	101.2	60.7	102.1	61.2	102.9	61.7	103.8	61.7	104.8	61.7	5			
	94.0	62.8	94.8	63.3	95.6	63.9	96.4	64.4	97.3	65.0	98.1	65.6	98.9	66.1	99.8	66.7	100.7	66.7	101.7	66.7	5			
4	90.8	67.3	91.6	67.9	92.4	68.5	93.2	69.1	94.0	69.7	94.8	70.3	95.6	70.9	96.4	71.5	97.4	71.5	98.4	71.5	4			
	87.3	71.7	88.1	72.3	88.9	73.0	89.7	73.6	90.4	74.2	91.2	74.9	92.0	75.5	92.8	76.1	93.8	76.1	94.8	76.1	4			
	83.7	75.9	84.5	76.5	85.2	77.2	85.9	77.9	86.7	78.6	87.4	79.2	88.2	79.9	88.9	80.6	89.9	80.6	90.9	80.6	4			
	79.9	79.9	80.6	80.6	81.3	81.3	82.0	82.0	82.7	82.7	83.4	83.4	84.1	84.1	84.8	84.8	85.5	85.5	86.2	85.5	4			
10	113.0	02.0	114.0	02.0	115.0	02.0	116.0	02.0	117.0	02.0	118.0	02.1	119.0	02.1	120.0	02.1	121.0	02.1	122.0	02.1	89°			
	112.9	03.9	113.9	04.0	114.9	04.0	115.9	04.0	116.9	04.1	117.9	04.1	118.9	04.2	119.9	04.2	120.9	04.2	121.9	04.2	88			
	112.8	05.9	113.8	06.0	114.8	06.0	115.8	06.1	116.8	06.1	117.8	06.2	118.8	06.2	119.8	06.3	120.8	06.3	121.8	06.3	87			
	112.7	07.9	113.7	08.0	114.7	08.0	115.7	08.1	116.7	08.2	117.7	08.2	118.7	08.3	119.7	08.4	120.7	08.4	121.7	08.4	86			
	112.6	09.8	113.6	09.9	114.6	10.0	115.6	10.1	116.6	10.2	117.6	10.3	118.5	10.4	119.5	10.5	120.5	10.5	121.5	10.5	85			
	112.4	11.8	113.4	11.9	114.4	12.0	115.4	12.1	116.4	12.2	117.4	12.3	118.3	12.4	119.3	12.5	120.3	12.5	121.3	12.5	84			
	112.2	13.8	113.2	13.9	114.1	14.0	115.1	14.1	116.1	14.3	117.1	14.4	118.1	14.5	119.1	14.6	120.1	14.6	121.1	14.6	83			
	111.9	15.7	112.9	15.9	113.9	16.0	114.9	16.1	115.9	16.3	116.9	16.4	117.8	16.6	118.8	16.7	119.8	16.7	120.8	16.7	82			
	111.6	17.7	112.6	17.8	113.6	18.0	114.6	18.1	115.6	18.3	116.5	18.5	117.5	18.6	118.5	18.8	119.5	18.8	120.5	18.8	81			
	111.3	19.6	112.3	19.8	113.3	20.0	114.2	20.1	115.2	20.3	116.2	20.5	117.2	20.7	118.2	20.8	119.2	20.8	120.2	20.8	80			
	111.0	21.6	111.9	21.8	112.9	21.9	113.9	22.1	114.9	22.3	115.8	22.5	116.8	22.7	117.8	22.9	118.8	22.9	119.8	22.9	79			
	110.9	23.5	111.5	23.7	112.5	23.9	113.5	24.1	114.4	24.3	115.4	24.5	116.4	24.7	117.4	24.9	118.4	24.9	119.4	24.9	78			
	110.1	25.4	111.1	25.6	112.1	25.9	113.0	26.1	114.0	26.3	115.0	26.5	116.0	26.8	116.9	27.0	117.9	27.0	118.9	27.0	77			
	109.6	27.3	110.6	27.6	111.6	27.8	112.6	28.1	113.5	28.3	114.5	28.6	115.5	28.8	116.4	29.0	117.4	29.0	118.4	29.0	76			
	109.1	29.2	110.1	29.5	111.1	29.8	112.0	30.0	113.0	30.3	114.0	30.5	114.9	30.8	115.9	31.1	116.9	31.1	117.9	31.1	75			
	108.6	31.1	109.6	31.4	110.5	31.7	111.5	32.0	112.5	32.2	113.4	32.5	114.4	32.8	115.4	33.1	116.4	33.1	117.4	33.1	74			
	108.1	33.0	109.0	33.3	110.0	33.6	110.9	33.9	111.9	34.2	112.8	34.5	113.8	34.8	114.8	35.1	115.8	35.1	116.8	35.1	73			
	107.5	34.9	108.4	35.2	109.4	35.5	110.3	35.8	111.3	36.2	112.2	36.5	113.2	36.8	114.1	37.1	115.1	37.1	116.1	37.1	72			
	106.8	36.8	107.8	37.1	108.7	37.4	109.7	37.8	110.6	38.1	111.6	38.4	112.5	38.7	113.5	39.1	114.5	39.1	115.5	39.1	71			
	106.2	38.6	107.1	39.0	108.1	39.3	109.0	39.7	109.9	40.0	110.9	40.4	111.8	40.7	112.8	41.0	113.8	41.0	114.8	41.0	70			
	105.5	40.5	106.4	40.9	107.4	41.2	108.3	41.6	109.2	41.9	110.2	42.3	111.1	42.6	112.0	43.0	113.0	43.0	114.0	43.0	69			
	104.8	42.3	105.7	42.7	106.6	43.1	107.6	43.5	108.5	43.8	109.4	44.2	110.3	44.6	111.3	45.0	112.3	45.0	113.3	45.0	68			
	104.0	44.2	104.9	44.5	105.9	44.9	106.8	45.3	107.7	45.7	108.6	46.1	109.5	46.5	110.5	46.9	111.5	46.9	112.5	46.9	67			
	103.2	46.0	104.1	46.4	105.1	46.8	106.0	47.2	106.9	47.6	107.8	48.0	108.7	48.4	109.6	48.8	110.6	48.8	111.6	48.8	66			
102.4	47.8	103.3	48.2	104.2	48.6	105.1	49.0	106.0	49.4	106.9	49.9	107.9	50.3	108.8	50.7	109.8	50.7	110.8	50.7	65				
101.6	49.5	102.5	50.0	103.4	50.4	104.3	50.9	105.2	51.3	106.1	51.7	107.0	52.2	107.9	52.6	108.9	52.6	109.9	52.6	64				
100.7	51.3	101.6	51.8	102.5	52.2	103.4	52.7	104.2	53.1	105.1	53.6	106.0	54.0	106.9	54.5	107.9	54.5	108.9	54.5	63				
99.8	53.1	100.7	53.5	101.5	54.0	102.4	54.5	103.3	54.9	104.2	55.4	105.1	55.9	106.0	56.3	107.0	56.3	108.0	56.3	62				
98.8	54.8	99.7	55.3	100.6	55.8	101.5	56.2	102.3	56.7	103.2	57.2	104.1	57.7	105.0	58.2	106.0	58.2	107.0	58.2	61				
97.9	56.5	98.7	57.0	99.6	57.5	100.5	58.0	101.3	58.5	102.2	59.0	103.1	59.5	103.9	60.0	104.9	60.0	105.9	60.0	60				
97.1	58.2	97.7	58.7	98.6	59.2	99.4	59.7	100.3	60.3	101.1	60.8	102.0	61.3	102.9	61.8	103.9	61.8	104.9	61.8	59				
96.2	59.9	96.7	60.4	97.5	60.9	98.4	61.5	99.2	62.0	100.1	62.5	100.9	63.1	101.8	63.6	102.8	63.6	103.8	63.6	58				
94.8	61.5	95.6	62.1	96.4	62.6	97.3	63.2	98.1	63.7	99.0	64.3	99.8	64.8	100.6	65.4	101.6	65.4	102.6	65.4	57				
93.7	63.2	94.5	63.7	95.3	64.3	96.2	64.9	97.0	65.4	97.8	66.0	97.7	66.5	99.5	67.1	100.5	67.1	101.5	67.1	56				
92.6	64.8	93.4	65.4	94.2	66.0	95.0	66.5	95.8	67.1	96.7	67.7	97.5	68.3	98.3	68.8	99.3	68.8	100.3	68.8	55				
91.4	66.4	92.2	67.0	93.0	67.6	93.8	68.2	94.7	68.8	95.5	69.4	96.3	69.9	97.1	70.5	94.5	70.5	95.5	70.5	54				
90.2	68.0	91.0	68.6	91.8	69.2	92.6	69.8	93.4	70.4	94.2	71.0	95.0	71.6	95.8	72.2	96.8	72.2	97.8	72.2	53				
89.0	69.6	89.8	70.2	90.6	70.8	91.4	71.4	92.2	72.0	93.0	72.6	93.8	73.3	94.6	73.9	95.2	73.9	96.5	73.9	52				
87.8	71.1	88.6	71.7	89.4	72.4	90.1	73.0	90.9	73.6	91.7	74.3	92.5	74.9	93.3	75.5	91.7	75.5	93.1	75.5	51				
86.6	72.6	87.3	73.3	88.1	73.9	88.9	74.6	89.6	75.2	90.4	75.8	91.2	76.5	91.9	77.1	90.1	77.1	92.7	77.1	50				
85.3	74.1	86.0	74.8	86.8	75.4	87.5	76.1	88.3	76.8	89.1	77.4	89.8	78.1	90.6	78.7	89.9	78.7	91.5	78.7	49				
84.0	75.6	84.7	76.3	85.5	77.0	86.2	77.6	86.9	78.3	87.7	79.0	88.4	79.6	89.2	80.3	88.9	79.6	91.1	80.3	48				
82.6	77.1	83.4	77.7	84.4	78.4	84.8	79.1	85.6	79.8	86.3	80.5	87.0	81.2	87.8	81.8	87.4	81.8	89.0	81.8	47				
81.3	78.5	82.0	79.2	82.7	79.9	83.4	80.6	84.2	81.3	84.9	82.0	85.6	82.7	86.3	83.4	86.6	83.4	89.4	83.4	46				
79.9	79.9	80.6	80.6	81.3	81.3	82.0	82.0	82.7	82.7	83.4	83.4	84.1	84.1	84.8	84.8	85.5	84.8	86.2	84.8	45				
Crs.	Dep.	Diff. Lat.</																						

Traverse Table.

(x.)

Distance. 121		122		123		124		125		126		127		128		Crse.
Crse.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crse.	
1	120.9 05.9	121.9 06.0	122.9 06.0	123.9 06.1	124.9 06.1	125.8 06.2	126.8 06.2	127.8 06.3	128.0 06.3	128.4 06.3	128.8 06.3	129.2 06.3	129.6 06.3	130.0 06.3	7	
2	120.4 11.9	121.4 12.0	122.4 12.1	123.4 12.2	124.4 12.3	125.4 12.3	126.4 12.4	127.4 12.5	128.4 12.5	128.8 12.5	129.2 12.5	129.6 12.5	130.0 12.5	130.4 12.5	8	
3	119.7 17.7	120.7 17.9	121.7 18.0	122.7 18.1	123.6 18.2	124.6 18.3	125.6 18.5	126.6 18.6	127.6 18.6	128.0 18.6	128.4 18.6	128.8 18.6	129.2 18.6	129.6 18.6	9	
4	118.7 23.6	119.7 23.8	120.6 24.0	121.6 24.2	122.6 24.4	123.6 24.6	124.6 24.8	125.6 25.0	126.6 25.1	127.6 25.1	128.6 25.1	129.6 25.1	130.0 25.1	130.4 25.1	10	
5	117.4 29.4	118.3 29.6	119.3 29.9	120.3 30.1	121.3 30.4	122.2 30.6	123.2 30.9	124.2 31.1	125.2 31.2	126.2 31.2	127.2 31.2	128.2 31.2	129.2 31.2	130.0 31.2	11	
6	115.8 35.1	116.8 35.4	117.7 35.7	118.7 36.0	119.6 36.3	120.6 36.6	121.5 36.9	122.5 37.2	123.5 37.2	124.5 37.2	125.5 37.2	126.5 37.2	127.5 37.2	128.4 37.2	12	
7	113.9 40.8	114.9 41.1	115.8 41.4	116.7 41.8	117.7 42.1	118.6 42.4	119.6 42.8	120.5 43.1	121.5 43.1	122.5 43.1	123.5 43.1	124.5 43.1	125.5 43.1	126.5 43.1	13	
8	111.8 46.3	112.7 46.7	113.6 47.1	114.6 47.5	115.5 47.8	116.4 48.2	117.3 48.6	118.3 49.0	119.3 49.0	120.3 49.0	121.3 49.0	122.3 49.0	123.3 49.0	124.3 49.0	14	
9	109.4 51.7	110.3 52.2	111.2 52.6	112.1 53.0	113.0 53.5	113.9 53.9	114.8 54.3	115.7 54.7	116.7 54.7	117.7 54.7	118.7 54.7	119.7 54.7	120.7 54.7	121.7 54.7	15	
10	106.7 57.0	107.6 57.5	108.5 58.0	109.4 58.4	110.2 58.9	111.1 59.4	112.0 59.9	112.9 60.3	113.9 60.3	114.8 60.3	115.8 60.3	116.8 60.3	117.8 60.3	118.8 60.3	16	
11	103.8 62.2	104.6 62.7	105.5 63.2	106.4 63.7	107.2 64.3	108.1 64.8	108.9 65.3	109.8 65.8	110.8 65.8	111.8 65.8	112.8 65.8	113.8 65.8	114.8 65.8	115.8 65.8	17	
12	100.6 67.2	101.4 67.8	102.3 68.3	103.1 68.9	103.9 69.4	104.8 70.0	105.6 70.6	106.6 71.1	107.6 71.1	108.6 71.1	109.6 71.1	110.6 71.1	111.6 71.1	112.6 71.1	18	
13	97.2 72.1	98.0 72.7	98.8 73.3	99.6 73.9	100.4 74.5	101.2 75.1	102.0 75.7	102.8 76.3	103.8 76.3	104.8 76.3	105.8 76.3	106.8 76.3	107.8 76.3	108.8 76.3	19	
14	93.5 76.8	94.3 77.4	95.1 78.0	95.8 78.7	96.6 79.3	97.4 79.9	98.2 80.6	98.9 81.2	99.9 81.2	100.9 81.2	101.9 81.2	102.9 81.2	103.9 81.2	104.9 81.2	20	
15	89.6 81.3	90.4 81.9	91.1 82.6	91.9 83.3	92.6 83.9	93.4 84.6	94.1 85.3	94.8 86.0	95.8 86.0	96.8 86.0	97.8 86.0	98.8 86.0	99.8 86.0	100.8 86.0	21	
16	85.6 85.6	86.3 86.3	87.0 87.0	87.7 87.7	88.4 88.4	89.1 89.1	89.8 89.8	90.5 90.5	91.5 90.5	92.5 90.5	93.5 90.5	94.5 90.5	95.5 90.5	96.5 90.5	22	
17	121.0 02.1	122.0 02.1	123.0 02.1	124.0 02.2	125.0 02.2	126.0 02.2	127.0 02.2	128.0 02.2	129.0 02.2	130.0 02.2	131.0 02.2	132.0 02.2	133.0 02.2	134.0 02.2	23	
18	120.9 04.2	121.9 04.3	122.9 04.3	123.9 04.3	124.9 04.4	125.9 04.4	126.9 04.4	127.9 04.5	128.9 04.5	129.9 04.5	130.9 04.5	131.9 04.5	132.9 04.5	133.9 04.5	24	
19	120.8 06.3	121.8 06.4	122.8 06.4	123.8 06.5	124.8 06.5	125.8 06.6	126.8 06.6	127.8 06.7	128.8 06.7	129.8 06.7	130.8 06.7	131.8 06.7	132.8 06.7	133.8 06.7	25	
20	120.7 08.4	121.7 08.5	122.7 08.6	123.7 08.6	124.7 08.7	125.7 08.8	126.7 08.8	127.7 08.9	128.7 08.9	129.7 08.9	130.7 08.9	131.7 08.9	132.7 08.9	133.7 08.9	26	
21	120.5 10.5	121.5 10.6	122.5 10.7	123.5 10.8	124.5 10.9	125.5 11.0	126.5 11.1	127.5 11.2	128.5 11.2	129.5 11.2	130.5 11.2	131.5 11.2	132.5 11.2	133.5 11.2	27	
22	120.3 12.6	121.3 12.8	122.3 12.9	123.3 13.0	124.3 13.1	125.3 13.2	126.3 13.3	127.3 13.4	128.3 13.4	129.3 13.4	130.3 13.4	131.3 13.4	132.3 13.4	133.3 13.4	28	
23	120.1 14.7	121.1 14.9	122.1 15.0	123.1 15.1	124.1 15.2	125.1 15.4	126.1 15.5	127.1 15.6	128.1 15.6	129.1 15.6	130.1 15.6	131.1 15.6	132.1 15.6	133.1 15.6	29	
24	119.8 16.8	120.8 17.0	121.8 17.1	122.8 17.3	123.8 17.4	124.8 17.5	125.8 17.7	126.8 17.8	127.8 17.8	128.8 17.8	129.8 17.8	130.8 17.8	131.8 17.8	132.8 17.8	30	
25	119.5 18.9	120.5 19.1	121.5 19.2	122.5 19.4	123.5 19.6	124.5 19.7	125.5 19.9	126.5 20.0	127.5 20.0	128.5 20.0	129.5 20.0	130.5 20.0	131.5 20.0	132.5 20.0	31	
26	119.2 21.0	120.1 21.2	121.1 21.4	122.1 21.5	123.1 21.7	124.1 21.9	125.1 22.1	126.1 22.2	127.1 22.2	128.1 22.2	129.1 22.2	130.1 22.2	131.1 22.2	132.1 22.2	32	
27	118.8 23.1	119.8 23.3	120.7 23.5	121.7 23.7	122.7 23.9	123.7 24.0	124.7 24.2	125.6 24.4	126.6 24.4	127.6 24.4	128.6 24.4	129.6 24.4	130.6 24.4	131.6 24.4	33	
28	118.4 25.2	119.3 25.4	120.3 25.6	121.3 25.8	122.3 26.0	123.2 26.2	124.2 26.4	125.2 26.6	126.2 26.6	127.2 26.6	128.2 26.6	129.2 26.6	130.2 26.6	131.2 26.6	34	
29	117.9 27.2	118.9 27.4	119.8 27.7	120.8 27.9	121.8 28.1	122.8 28.3	123.7 28.6	124.7 28.8	125.7 28.8	126.7 28.8	127.7 28.8	128.7 28.8	129.7 28.8	130.7 28.8	35	
30	117.4 29.3	118.4 29.5	119.3 29.8	120.3 30.0	121.3 30.2	122.3 30.5	123.2 30.7	124.2 31.0	125.2 31.0	126.2 31.0	127.2 31.0	128.2 31.0	129.2 31.0	130.2 31.0	36	
31	116.9 31.3	117.8 31.6	118.8 31.8	119.8 32.1	120.7 32.4	121.7 32.6	122.7 32.9	123.6 33.1	124.6 33.1	125.6 33.1	126.6 33.1	127.6 33.1	128.6 33.1	129.6 33.1	37	
32	116.3 33.4	117.3 33.6	118.2 33.9	119.2 34.2	120.2 34.5	121.1 34.7	122.1 35.0	123.0 35.3	124.0 35.3	125.0 35.3	126.0 35.3	127.0 35.3	128.0 35.3	129.0 35.3	38	
33	115.7 35.5	116.7 35.7	117.6 36.0	118.6 36.3	119.5 36.5	120.5 36.8	121.5 37.1	122.4 37.4	123.4 37.4	124.4 37.4	125.4 37.4	126.4 37.4	127.4 37.4	128.4 37.4	39	
34	115.1 37.4	116.0 37.7	117.0 38.0	117.9 38.3	118.9 38.6	119.8 38.9	120.8 39.2	121.7 39.6	122.7 39.6	123.7 39.6	124.7 39.6	125.7 39.6	126.7 39.6	127.7 39.6	40	
35	114.4 39.4	115.4 39.7	116.3 40.0	117.2 40.4	118.2 40.7	119.1 41.0	120.1 41.3	121.0 41.7	122.0 41.7	123.0 41.7	124.0 41.7	125.0 41.7	126.0 41.7	127.0 41.7	41	
36	113.7 41.4	114.6 41.7	115.6 42.1	116.5 42.4	117.5 42.8	118.4 43.1	119.3 43.4	120.3 43.8	121.3 43.8	122.3 43.8	123.3 43.8	124.3 43.8	125.3 43.8	126.3 43.8	42	
37	113.0 43.4	113.9 43.7	114.8 44.1	115.8 44.4	116.7 44.8	117.6 45.2	118.6 45.5	119.5 45.9	120.5 45.9	121.5 45.9	122.5 45.9	123.5 45.9	124.5 45.9	125.5 45.9	43	
38	112.2 45.3	113.1 45.7	114.0 46.1	115.0 46.5	115.9 46.8	116.8 47.2	117.8 47.6	118.7 47.9	119.7 47.9	120.7 47.9	121.7 47.9	122.7 47.9	123.7 47.9	124.7 47.9	44	
39	111.4 47.3	112.3 47.7	113.2 48.1	114.1 48.5	115.1 48.8	116.0 49.2	116.9 49.6	117.8 50.0	118.8 50.0	119.8 50.0	120.8 50.0	121.8 50.0	122.8 50.0	123.8 50.0	45	
40	110.5 49.2	111.5 49.6	112.4 50.0	113.3 50.4	114.2 50.8	115.1 51.2	116.0 51.7	116.9 52.1	117.9 52.1	118.9 52.1	119.9 52.1	120.9 52.1	121.9 52.1	122.9 52.1	46	
41	109.7 51.1	110.6 51.6	111.5 52.0	112.4 52.4	113.3 52.8	114.2 53.2	115.1 53.7	116.0 54.1	117.0 54.1	118.0 54.1	119.0 54.1	120.0 54.1	121.0 54.1	122.0 54.1	47	
42	108.8 53.0	109.7 53.5	110.6 53.9	111.5 54.3	112.4 54.8	113.2 55.2	114.1 55.7	115.0 56.1	116.0 56.1	117.0 56.1	118.0 56.1	119.0 56.1	120.0 56.1	121.0 56.1	48	
43	107.8 54.9	108.7 55.4	109.6 55.8	110.5 56.3	111.4 56.7	112.3 57.2	113.2 57.7	114.0 58.1	115.0 58.1	116.0 58.1	117.0 58.1	118.0 58.1	119.0 58.1	120.0 58.1	49	
44	106.8 56.8	107.7 57.3	108.6 57.7	109.5 58.2	110.4 58.7	111.3 59.2	112.1 59.6	113.0 60.1	114.0 60.1	115.0 60.1	116.0 60.1	117.0 60.1	118.0 60.1	119.0 60.1	50	
45	105.8 58.7	106.7 59.1	107.6 59.6	108.5 60.1	109.3 60.6	110.2 61.1	111.1 61.6	112.0 62.1	113.0 62.1	114.0 62.1	115.0 62.1	116.0 62.1	117.0 62.1	118.0 62.1	51	
46	104.8 60.5	105.7 61.0	106.5 61.5	107.4 62.0	108.3 62.5	109.1 63.0	110.0 63.5	110.9 64.0	111.9 64.0	112.9 64.0	113.9 64.0	114.9 64.0	115.9 64.0	116.9 64.0	52	
47	103.7 62.3	104.6 62.8	105.4 63.3	106.3 63.9	107.1 64.4	108.0 64.9	108.9 65.4	109.7 65.9	110.7 65.9	111.7 65.9	112.7 65.9	113.7 65.9	114.7 65.9	115.7 65.9	53	
48	102.6 64.1	103.5 64.7	104.3 65.2	105.2 65.7	106.0 66.2	106.9 66.6	107.7 67.3	108.6 67.8	109.6 67.8	110.6 67.8	111.6 67.8	112.6 67.8	113.6 67.8	114.6 67.8	54	
49	101.5 65.9	102.3 66.4	103.2 67.0	104.0 67.5	104.8 68.1	105.7 68.6	106.5 69.2	107.3 69.7	108.3 69.7	109.3 69.7	110.3 69.7	111.3 69.7	112.3 69.7	113.3 69.7	55	
50	100.3 67.7	101.1 68.2	102.0 68.8	102.8 69.3	103.6 69.9	104.5 70.5	105.3 71.0	106.1 71.6	107.1 71.6	108.1 71.6	109.1 71.6	110.1 71.6	111.1 71.6	112.1 71.6	56	
51	99.1 69.4	99.9 69.9	100.8 70.5	101.6 71.1	102.4 71.7	103.2 72.3	104.0 72.8	104.9 73.4	105.9 73.4	106.9 73.4	107.9 73.4	108.9 73.4	109.9 73.4	110.9 73.4	57	
52	97.9 71.1	98.7 71.7	99.5 72.3	100.3 72.9	101.1 73.5	101.9 74.1	102.7 74.6	103.6 75.2	104.6 75.2	105.6 75.2	106.6 75.2	1				

Traverse Table.

(x.)

Distance. 129		130		131		132		133		134		135		136		Crse.
Crse.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crse.	
1	128.8 06.3	129.8 06.4	130.8 06.4	131.8 06.5	132.8 06.5	133.8 06.6	134.8 06.6	135.8 06.7	136.8 06.7	137.8 06.8	138.8 06.8	139.8 06.9	140.8 06.9	141.8 07.0	142.8 07.0	1
2	128.4 12.6	129.4 12.7	130.4 12.8	131.4 12.9	132.4 13.0	133.4 13.1	134.4 13.2	135.4 13.3	136.4 13.3	137.4 13.4	138.4 13.5	139.4 13.6	140.4 13.6	141.4 13.7	142.4 13.7	2
3	127.6 18.9	128.6 19.1	129.6 19.2	130.6 19.4	131.6 19.5	132.6 19.7	133.6 19.8	134.6 19.9	135.6 20.0	136.6 20.1	137.6 20.2	138.6 20.3	139.6 20.4	140.6 20.5	141.6 20.5	3
4	126.5 25.2	127.5 25.4	128.5 25.6	129.5 25.8	130.4 26.0	131.4 26.1	132.4 26.3	133.4 26.5	134.4 26.6	135.4 26.8	136.4 27.0	137.4 27.1	138.4 27.3	139.4 27.4	140.4 27.5	4
5	125.1 31.3	126.1 31.6	127.1 31.8	128.0 32.1	129.0 32.3	130.0 32.6	131.0 32.8	132.0 33.0	133.0 33.2	134.0 33.4	135.0 33.6	136.0 33.8	137.0 34.0	138.0 34.2	139.0 34.4	5
6	123.5 37.4	124.4 37.7	125.4 38.0	126.3 38.3	127.3 38.6	128.2 38.9	129.2 39.2	130.1 39.5	131.0 39.8	132.0 40.1	133.0 40.4	134.0 40.7	135.0 41.0	136.0 41.3	137.0 41.6	6
7	121.5 43.5	122.4 43.8	123.3 44.1	124.3 44.5	125.2 44.8	126.2 45.1	127.1 45.5	128.0 45.8	129.0 46.2	130.0 46.5	131.0 46.9	132.0 47.2	133.0 47.6	134.0 47.9	135.0 48.3	7
8	119.2 49.4	120.1 49.8	121.0 50.1	122.0 50.5	122.9 50.9	123.8 51.3	124.7 51.7	125.7 52.0	126.6 52.4	127.5 52.8	128.5 53.2	129.4 53.6	130.4 54.0	131.3 54.4	132.3 54.8	8
9	116.6 55.2	117.5 55.6	118.4 56.0	119.3 56.4	120.2 56.9	121.1 57.3	122.0 57.7	122.9 58.2	123.8 58.6	124.7 59.0	125.6 59.4	126.5 59.8	127.5 60.2	128.4 60.6	129.3 61.0	9
10	113.8 60.8	114.7 61.3	115.5 61.7	116.4 62.2	117.3 62.7	118.2 63.2	119.1 63.6	119.9 64.1	120.8 64.5	121.7 64.9	122.6 65.3	123.5 65.7	124.4 66.1	125.3 66.5	126.2 66.9	10
11	110.6 66.3	111.5 66.8	112.4 67.3	113.2 67.9	114.1 68.4	114.9 68.9	115.8 69.4	116.6 69.9	117.5 70.3	118.4 70.7	119.3 71.1	120.2 71.5	121.1 71.9	122.0 72.3	122.9 72.7	11
12	107.3 71.7	108.1 72.2	108.9 72.8	109.7 73.3	110.6 73.8	111.4 74.4	112.2 75.0	113.1 75.6	114.0 76.0	114.9 76.5	115.8 77.0	116.7 77.4	117.6 77.8	118.5 78.2	119.4 78.6	12
13	103.6 76.9	104.4 77.4	105.2 78.0	106.0 78.6	106.8 79.2	107.6 79.8	108.4 80.4	109.2 81.0	110.0 81.6	110.8 82.2	111.6 82.8	112.4 83.4	113.2 84.0	114.0 84.6	114.8 85.2	13
14	99.7 81.8	100.5 82.5	101.3 83.1	102.0 83.7	102.8 84.4	103.6 85.0	104.4 85.6	105.1 86.3	105.9 86.9	106.7 87.5	107.5 88.1	108.3 88.7	109.1 89.3	109.9 89.9	110.7 90.5	14
15	95.6 86.6	96.3 87.3	97.1 88.0	97.8 88.6	98.5 89.3	99.3 90.0	100.0 90.7	100.8 91.3	101.5 92.0	102.3 92.7	103.0 93.4	103.8 94.1	104.5 94.8	105.3 95.5	106.0 96.2	15
16	91.2 91.2	91.9 91.9	92.6 92.6	93.3 93.3	94.0 94.0	94.8 94.8	95.5 95.5	96.2 96.2	97.0 97.0	97.8 97.8	98.5 98.5	99.3 99.3	100.0 100.0	100.8 100.8	101.5 101.5	16
17	129.0 02.3	130.0 02.3	131.0 02.3	132.0 02.3	133.0 02.3	134.0 02.3	135.0 02.4	136.0 02.4	137.0 02.4	138.0 02.5	139.0 02.5	140.0 02.6	141.0 02.6	142.0 02.7	143.0 02.7	17
18	128.9 04.5	129.9 04.5	130.9 04.6	131.9 04.6	132.9 04.6	133.9 04.7	134.9 04.7	135.9 04.7	136.9 04.8	137.9 04.8	138.9 04.9	139.9 04.9	140.9 05.0	141.9 05.0	142.9 05.1	18
19	128.8 06.8	129.8 06.8	130.8 06.9	131.8 06.9	132.8 07.0	133.8 07.0	134.8 07.1	135.8 07.1	136.8 07.2	137.8 07.2	138.8 07.3	139.8 07.3	140.8 07.4	141.8 07.4	142.8 07.5	19
20	128.7 09.0	129.7 09.1	130.7 09.1	131.7 09.2	132.7 09.3	133.7 09.3	134.7 09.4	135.7 09.5	136.7 09.5	137.7 09.6	138.7 09.6	139.7 09.7	140.7 09.7	141.7 09.8	142.7 09.8	20
21	128.5 11.2	129.5 11.3	130.5 11.4	131.5 11.5	132.5 11.6	133.5 11.7	134.5 11.8	135.5 11.9	136.5 12.0	137.5 12.0	138.5 12.1	139.5 12.1	140.5 12.2	141.5 12.2	142.5 12.3	21
22	128.3 13.5	129.3 13.6	130.3 13.7	131.3 13.8	132.3 13.9	133.3 14.0	134.3 14.1	135.3 14.2	136.3 14.3	137.3 14.3	138.3 14.4	139.3 14.5	140.3 14.5	141.3 14.6	142.3 14.6	22
23	128.0 15.7	129.0 15.8	130.0 16.0	131.0 16.1	132.0 16.2	133.0 16.3	134.0 16.5	135.0 16.6	136.0 16.7	137.0 16.8	138.0 16.9	139.0 17.0	140.0 17.1	141.0 17.1	142.0 17.2	23
24	127.7 18.0	128.7 18.1	129.7 18.2	130.7 18.4	131.7 18.5	132.7 18.6	133.7 18.8	134.7 18.9	135.7 19.0	136.7 19.1	137.7 19.2	138.7 19.3	139.7 19.4	140.7 19.5	141.7 19.5	24
25	127.4 20.2	128.4 20.3	129.4 20.5	130.4 20.6	131.4 20.8	132.4 21.0	133.4 21.1	134.4 21.3	135.4 21.4	136.4 21.5	137.4 21.6	138.4 21.7	139.4 21.8	140.4 21.9	141.4 21.9	25
26	127.0 22.4	128.0 22.6	129.0 22.7	130.0 22.9	131.0 23.1	132.0 23.3	133.0 23.4	134.0 23.6	135.0 23.7	136.0 23.8	137.0 23.9	138.0 24.0	139.0 24.1	140.0 24.2	141.0 24.2	26
27	126.6 24.6	127.6 24.8	128.6 25.0	129.6 25.2	130.6 25.4	131.6 25.6	132.6 25.8	133.6 25.9	134.6 26.1	135.6 26.2	136.6 26.4	137.6 26.5	138.6 26.6	139.6 26.7	140.6 26.8	27
28	126.2 26.8	127.2 27.0	128.1 27.2	129.1 27.4	130.1 27.7	131.1 27.9	132.0 28.1	133.0 28.3	134.0 28.4	135.0 28.6	136.0 28.7	137.0 28.9	138.0 29.0	139.0 29.1	140.0 29.2	28
29	125.7 29.0	126.7 29.2	127.6 29.5	128.6 29.7	129.6 29.9	130.6 30.1	131.5 30.4	132.5 30.6	133.5 30.7	134.5 30.9	135.5 31.0	136.5 31.2	137.5 31.3	138.5 31.5	139.5 31.6	29
30	125.2 31.2	126.1 31.4	127.1 31.7	128.1 31.9	129.0 32.2	130.0 32.4	131.0 32.7	132.0 32.9	133.0 33.1	134.0 33.2	135.0 33.4	136.0 33.6	137.0 33.7	138.0 33.9	139.0 34.0	30
31	124.6 33.4	125.6 33.6	126.5 33.9	127.5 34.2	128.5 34.4	129.4 34.7	130.4 34.9	131.4 35.2	132.4 35.4	133.4 35.6	134.4 35.8	135.4 36.0	136.4 36.2	137.4 36.4	138.4 36.5	31
32	124.0 35.6	125.0 35.8	125.9 36.1	126.9 36.4	127.8 36.7	128.8 36.9	129.8 37.2	130.7 37.5	131.7 37.7	132.7 37.9	133.7 38.2	134.7 38.4	135.7 38.6	136.7 38.8	137.7 39.0	32
33	123.4 37.7	124.3 38.0	125.3 38.3	126.2 38.6	127.2 38.9	128.1 39.2	129.1 39.5	130.1 39.8	131.1 40.0	132.1 40.3	133.1 40.5	134.1 40.8	135.1 41.0	136.1 41.3	137.1 41.5	33
34	122.7 39.9	123.6 40.2	124.6 40.5	125.5 40.8	126.5 41.1	127.4 41.4	128.4 41.7	129.3 42.0	130.3 42.3	131.3 42.6	132.3 42.9	133.3 43.2	134.3 43.5	135.3 43.8	136.3 44.0	34
35	122.0 42.0	122.9 42.3	123.9 42.6	124.8 43.0	125.8 43.3	126.7 43.6	127.6 44.0	128.6 44.3	129.6 44.6	130.6 44.9	131.6 45.2	132.6 45.5	133.6 45.8	134.6 46.1	135.6 46.4	35
36	121.2 44.1	122.2 44.5	123.1 44.8	124.0 45.1	125.0 45.5	125.9 45.8	126.9 46.2	127.8 46.5	128.8 46.9	129.8 47.2	130.8 47.5	131.8 47.8	132.8 48.1	133.8 48.4	134.8 48.7	36
37	120.4 46.2	121.4 46.6	122.3 46.9	123.2 47.3	124.2 47.7	125.1 48.0	126.0 48.4	127.0 48.7	128.0 49.0	129.0 49.3	130.0 49.6	131.0 49.9	132.0 50.2	133.0 50.5	134.0 50.8	37
38	119.6 48.3	120.5 48.7	121.5 49.1	122.4 49.4	123.3 49.8	124.2 50.2	125.2 50.6	126.1 50.9	127.1 51.2	128.1 51.5	129.1 51.8	130.1 52.1	131.1 52.4	132.1 52.7	133.1 53.0	38
39	118.7 50.4	119.7 50.8	120.6 51.2	121.5 51.6	122.4 52.0	123.3 52.4	124.3 52.7	125.3 53.1	126.3 53.4	127.3 53.7	128.3 54.0	129.3 54.3	130.3 54.6	131.3 54.9	132.3 55.2	39
40	117.8 52.5	118.8 52.9	119.7 53.3	120.6 53.7	121.5 54.1	122.4 54.5	123.3 54.9	124.2 55.3	125.2 55.6	126.2 56.0	127.2 56.3	128.2 56.6	129.2 56.9	130.2 57.2	131.2 57.5	40
41	116.9 54.5	117.8 54.9	118.7 55.4	119.6 55.8	120.5 56.2	121.4 56.6	122.4 57.1	123.3 57.5	124.3 57.9	125.3 58.2	126.3 58.6	127.3 58.9	128.3 59.2	129.3 59.5	130.3 59.8	41
42	115.9 56.5	116.8 57.0	117.7 57.4	118.6 57.9	119.5 58.3	120.4 58.7	121.3 59.2	122.2 59.6	123.2 59.9	124.2 60.3	125.2 60.6	126.2 61.0	127.2 61.3	128.2 61.6	129.2 61.9	42
43	114.9 58.6	115.8 59.0	116.7 59.5	117.6 59.9	118.5 60.4	119.4 60.8	120.3 61.3	121.2 61.7	122.2 62.0	123.2 62.4	124.2 62.8	125.2 63.1	126.2 63.5	127.2 63.8	128.2 64.1	43
44	113.9 60.6	114.8 61.0	115.7 61.5	116.5 62.0	117.4 62.4	118.3 62.9	119.2 63.4	120.1 63.8	121.1 64.2	122.1 64.6	123.1 65.0	124.1 65.4	125.1 65.7	126.1 66.1	127.1 66.4	44
45	112.8 62.5	113.7 63.0	114.6 63.5	115.4 64.0	116.3 64.5	117.2 65.0	118.1 65.4	119.0 65.8	120.0 66.2	121.0 66.6	122.0 67.0	123.0 67.4	124.0 67.7	125.0 68.1	126.0 68.4	45
46	111.7 64.5	112.6 65.0	113.4 65.5	114.3 66.0	115.2 66.5	116.0 67.0	116.9 67.5	117.8 68.0	118.7 68.4	119.6 68.8	120.5 69.2	121.4 69.6	122.3 69.9	123.2 70.3	124.1 70.6	46
47	110.6 66.4	111.4 67.0	112.3 67.5	113.1 68.0	114.0 68.5	114.9 69.0	115.8 69.5	116.7 70.0	117.6 70.4	118.5 70.8	119.4 71.2	120.3 71.6	121.2 71.9	122.1 72.3	123.0 72.6	47
48	109.4 68.4	110.2 68.9	111.1 69.4	111.9 69.9	112.8 70.5	113.6 71.0	114.5 71.5	115.3 72.0	116.2 72.4	117.1 72.8	118.0 73.2	118.9 73.6	119.8 74.0	120.7 74.3	121.6 74.7	48
49	108.2 70.3	109.0 70.8	109.9 71.3	110.7 71.9	111.5 72.4	112.4 73.0	113.2 73.5	114.1 74								

Distance. 137			138			139			140			141			142			143			144			Crs. Pts.
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs. Pts.			
1	136.8	06.7	137.8	06.8	138.8	06.8	139.8	06.9	140.8	06.9	141.8	07.0	142.8	07.0	143.8	07.1					7			
	136.3	13.4	137.3	13.5	138.3	13.6	139.3	13.7	140.3	13.8	141.3	13.9	142.3	14.0	143.3	14.1					7			
	135.5	20.1	136.5	20.2	137.5	20.4	138.5	20.5	139.5	20.7	140.5	20.8	141.4	21.0	142.4	21.1					7			
	134.4	26.7	135.3	26.9	136.3	27.1	137.3	27.3	138.3	27.5	139.3	27.7	140.2	27.9	141.2	28.1					7			
	132.9	33.3	133.9	33.5	134.8	33.8	135.8	34.0	136.8	34.3	137.7	34.5	138.7	34.7	139.7	35.0					7			
2	131.1	39.8	132.1	40.1	133.0	40.3	134.0	40.6	134.9	40.9	135.9	41.2	136.8	41.5	137.8	41.8					6			
	129.0	46.1	129.9	46.5	130.9	46.8	131.8	47.2	132.8	47.5	133.7	47.8	134.6	48.2	135.6	48.5					6			
	126.6	52.4	127.5	52.8	128.4	53.2	129.3	53.6	130.3	54.0	131.2	54.3	132.1	54.7	133.0	55.1					6			
	123.8	58.6	124.7	59.0	125.7	59.4	126.6	59.9	127.5	60.3	128.4	60.7	129.3	61.2	130.2	61.6					6			
	120.8	64.6	121.7	65.0	122.6	65.5	123.5	66.0	124.4	66.5	125.2	66.9	126.1	67.4	127.0	67.9					6			
3	117.5	70.4	118.4	70.9	119.2	71.5	120.1	72.0	120.9	72.5	121.8	73.0	122.7	73.5	123.5	74.0					5			
	113.9	76.1	114.7	76.7	115.6	77.2	116.4	77.8	117.2	78.3	118.1	78.9	118.9	79.4	119.7	80.0					5			
	110.0	81.6	110.8	82.2	111.6	82.8	112.4	83.4	113.2	84.0	114.0	84.6	114.9	85.2	115.7	85.8					5			
	105.9	86.9	106.7	87.5	107.4	88.2	108.2	88.8	109.0	89.4	109.8	90.1	110.5	90.7	111.3	91.3					5			
	101.5	92.0	102.2	92.7	103.0	93.3	103.7	94.0	104.5	94.7	105.2	95.4	106.0	96.0	106.7	96.7					5			
4	96.9	96.9	97.6	97.6	98.3	98.3	99.0	99.0	99.7	99.7	100.4	100.4	101.1	101.1	101.8	101.8					4			
	137.0	02.4	138.0	02.4	139.0	02.4	140.0	02.4	141.0	02.5	142.0	02.5	143.0	02.5	144.0	02.5					89°			
	136.9	04.8	137.9	04.8	138.9	04.9	139.9	04.9	140.9	04.9	141.9	05.0	142.9	05.0	143.9	05.0					88			
	136.8	07.2	137.8	07.2	138.8	07.3	139.8	07.3	140.8	07.4	141.8	07.4	142.8	07.5	143.8	07.5					87			
	136.7	09.6	137.7	09.6	138.7	09.7	139.7	09.8	140.7	09.8	141.7	09.9	142.7	10.0	143.6	10.0					86			
5	136.5	11.9	137.5	12.0	138.5	12.1	139.5	12.2	140.5	12.3	141.5	12.4	142.5	12.5	143.5	12.6					85			
	136.2	14.3	137.2	14.4	138.2	14.5	139.2	14.6	140.2	14.7	141.2	14.8	142.2	14.9	143.2	15.1					84			
	136.0	16.7	137.0	16.8	138.0	16.9	139.0	17.1	139.9	17.2	140.9	17.3	141.9	17.4	142.9	17.5					83			
	135.7	19.1	136.7	19.2	137.7	19.3	138.6	19.5	139.6	19.6	140.6	19.8	141.6	19.9	142.6	20.0					82			
	135.3	21.4	136.3	21.6	137.3	21.7	138.3	21.9	139.3	22.1	140.3	22.2	141.2	22.4	142.2	22.5					81			
6	134.9	23.8	135.9	24.0	136.9	24.1	137.9	24.3	138.9	24.5	139.8	24.7	140.8	24.8	141.8	25.0					80			
	134.5	26.1	135.5	26.3	136.4	26.5	137.4	26.7	138.4	26.9	139.4	27.1	140.4	27.3	141.4	27.5					79			
	134.0	28.5	135.0	28.7	136.0	28.9	136.9	29.1	137.9	29.3	138.9	29.5	139.9	29.7	140.9	29.9					78			
	133.5	30.8	134.5	31.0	135.4	31.3	136.4	31.5	137.4	31.7	138.4	31.9	139.3	32.2	140.3	32.4					77			
	132.9	33.1	133.9	33.4	134.9	33.6	135.8	33.9	136.8	34.1	137.8	34.4	138.8	34.6	139.7	34.8					76			
7	132.3	35.5	133.3	35.7	134.3	36.0	135.2	36.2	136.2	36.5	137.2	36.8	138.1	37.0	139.1	37.3					75			
	131.7	37.8	132.7	38.0	133.6	38.3	134.6	38.6	135.5	38.9	136.5	39.1	137.5	39.4	138.4	39.7					74			
	131.0	40.1	132.0	40.3	132.9	40.6	133.9	40.9	134.8	41.2	135.8	41.5	136.8	41.8	137.7	42.1					73			
	130.3	42.3	131.2	42.6	132.2	43.0	133.1	43.3	134.1	43.6	135.1	43.9	136.0	44.2	137.0	44.5					72			
	129.5	44.6	130.5	44.9	131.4	45.3	132.4	45.6	133.3	45.9	134.3	46.2	135.2	46.6	136.2	46.9					71			
8	128.7	46.9	129.7	47.2	130.6	47.5	131.6	47.9	132.5	48.2	133.4	48.6	134.4	48.9	135.3	49.3					70			
	127.9	49.1	128.8	49.5	129.8	49.8	130.7	50.2	131.6	50.5	132.6	50.9	133.5	51.2	134.4	51.6					69			
	127.0	51.3	128.0	51.7	128.9	52.1	129.8	52.4	130.7	52.8	131.7	53.2	132.6	53.6	133.5	53.9					68			
	126.1	53.5	127.0	53.9	128.0	54.3	128.9	54.7	129.8	55.1	130.7	55.5	131.6	55.9	132.6	56.3					67			
	125.2	55.7	126.1	56.1	127.0	56.5	127.9	56.9	128.8	57.3	129.7	57.8	130.6	58.2	131.6	58.6					66			
9	124.2	57.9	125.1	58.3	126.0	58.7	126.9	59.2	127.8	59.6	128.7	60.0	129.6	60.4	130.5	60.9					65			
	123.1	60.1	124.0	60.5	124.9	60.9	125.8	61.4	126.7	61.8	127.6	62.2	128.5	62.7	129.4	63.1					64			
	122.1	62.2	123.0	62.7	123.8	63.1	124.7	63.6	125.6	64.0	126.5	64.5	127.4	64.9	128.3	65.4					63			
	121.0	64.3	121.8	64.8	122.7	65.3	123.6	65.7	124.5	66.2	125.4	66.7	126.3	67.1	127.1	67.6					62			
	119.8	66.4	120.7	66.9	121.6	67.4	122.4	67.9	123.3	68.4	124.2	68.8	125.1	69.3	125.9	69.8					61			
10	118.6	68.5	119.5	69.0	120.4	69.5	121.2	70.0	122.1	70.5	123.0	71.0	123.8	71.5	124.7	72.0					60			
	117.4	70.6	118.3	71.1	119.1	71.6	120.0	72.1	120.9	72.6	121.7	73.1	122.6	73.7	123.4	74.2					59			
	116.2	72.6	117.0	73.1	117.9	73.7	118.7	74.2	119.6	74.7	120.4	75.2	121.3	75.8	122.1	76.3					58			
	114.9	74.6	115.7	75.2	116.6	75.7	117.4	76.2	118.3	76.8	119.1	77.3	119.9	77.9	120.8	78.4					57			
	113.6	76.6	114.4	77.2	115.2	77.7	116.1	78.3	116.9	78.8	117.7	79.4	118.6	80.0	119.4	80.5					56			
11	112.2	78.6	113.0	79.2	113.9	79.7	114.7	80.3	115.5	80.9	116.3	81.4	117.1	82.0	118.0	82.6					55			
	110.8	80.5	111.6	81.1	112.5	81.7	113.3	82.3	114.1	82.9	114.9	83.5	115.7	84.1	116.5	84.6					54			
	109.4	82.4	110.2	83.1	111.0	83.7	111.8	84.3	112.6	84.9	113.4	85.5	114.2	86.1	115.0	86.7					53			
	108.0	84.3	108.7	85.0	109.5	85.6	110.3	86.2	111.1	86.8	111.9	87.4	112.7	88.0	113.5	88.7					52			
	106.5	86.2	107.2	86.8	108.5	87.5	108.8	88.1	109.6	88.7	110.4	89.4	111.1	90.0	111.9	90.6					51			
12	104.9	88.1	105.7	88.7	106.5	89.3	107.2	90.0	108.0	90.6	108.8	91.3	109.5	91.9	110.3	92.6					50			
	103.4	89.9	104.1	90.5	104.9	91.2	105.7	91.8	106.4	92.5	107.2	93.2	107.9	93.8	108.7	94.5					49			
	101.8	91.7	102.6	92.3	103.3	93.0	104.0	93.7	104.8	94.3	105.5	95.0	106.3	95.7	107.0	96.4					48			
	100.2	93.4	100.9	94.1	101.7	94.8	102.4	95.5	103.1	96.2	103.9	96.8	104.6	97.5	105.3	98.2					47			
	98.5	95.2	99.3	95.9	100.0	96.6	100.7	97.3	101.4	97.9	102.1	98.6	102.9	99.3	103.6	100.0					46			
13	96.9	96.9	97.6	97.6	98.3	98.3	99.0	99.0	99.7	99.7	100.4	100.4	101.1	101.1	101.8	101.8					45			
	137.0	02.4	138.0	02.4	139.0	02.4	140.0	02.4	141.0	02.5	142.0	02.5	143.0	02.5	144.0	02.5					89°			
	136.9	04.8	137.9	04.8	138.9	04.9	139.9	04.9	140.9	04.9	141.9	05.0	142.9	05.0	143.9	05.0					88			
	136.8	07.2	137.8	07.2	138.8	07.3	139.8	07.3	140.8	07.4	141.8	07.4	142.8	07.5	143.8	07.5					87			
	136.7	09.6	137.7	09.6	138.7	09.7	139.7	09.8	140.7	09.8	141.7	09.9	142.7	10.0	143.6	10.0					86			
14	136.5	11.9	137.5	12.0	138.5	12.1	139.5	12.2	140.5	12.3	141.5	12.4	142.5	12.5	143.5	12.6					85			
	136.2	14.3	137.2	14.4	138.2	14.5	139.2	14.6	140.2	14.7	141.2	14.8	142.2	14.9	143.2	15.1					84			
	136.0</																							

(x.)

Traverse Table.

Distance. 145			146			147			148			149			150			151			152			Crse. Pts.
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse.			
1	144.8	07.1	145.8	07.2	146.8	07.2	147.8	07.3	148.8	07.3	149.8	07.4	150.8	07.4	151.8	07.5	72	1	144.8	07.1	145.8	07.2		
	144.3	14.3	145.3	14.3	146.3	14.4	147.3	14.5	148.3	14.6	149.3	14.7	150.3	14.8	151.3	14.9	73	1	144.3	14.3	145.3	14.4		
	143.4	21.3	144.4	21.4	145.4	21.6	146.4	21.7	147.4	21.9	148.4	22.0	149.4	22.2	150.3	22.3	74	1	143.4	21.3	144.4	21.4		
	142.2	28.3	143.2	28.5	144.2	28.7	145.2	28.9	146.1	29.1	147.1	29.3	148.1	29.5	149.1	29.7	75	1	142.2	28.3	143.2	28.5		
2	140.7	35.2	141.6	35.5	142.6	35.7	143.6	36.0	144.5	36.2	145.5	36.5	146.5	36.7	147.4	36.9	76	2	140.7	35.2	141.6	35.5		
	138.8	42.1	139.7	42.4	140.7	42.7	141.6	43.0	142.6	43.2	143.5	43.5	144.5	43.8	145.5	44.1	77	2	138.8	42.1	139.7	42.4		
	136.5	48.8	137.5	49.2	138.4	49.5	139.3	49.9	140.3	50.2	141.2	50.5	142.2	50.9	143.1	51.2	78	2	136.5	48.8	137.5	49.2		
	134.0	55.5	134.9	55.9	135.8	56.3	136.7	56.6	137.7	57.0	138.6	57.4	139.5	57.8	140.4	58.2	79	2	134.0	55.5	134.9	55.9		
3	131.1	62.0	132.0	62.4	132.9	62.9	133.8	63.3	134.7	63.7	135.6	64.1	136.5	64.6	137.4	65.0	80	3	131.1	62.0	132.0	62.4		
	127.9	68.5	128.8	68.8	129.6	69.3	130.5	69.8	131.4	70.2	132.3	70.7	133.2	71.2	134.1	71.6	81	3	127.9	68.5	128.8	68.8		
	124.4	74.5	125.2	75.1	126.1	75.6	126.9	76.1	127.8	76.6	128.7	77.1	129.5	77.6	130.4	78.1	82	3	124.4	74.5	125.2	75.1		
	120.6	80.6	121.4	81.1	122.2	81.7	123.1	82.2	123.9	82.8	124.7	83.3	125.5	83.9	126.4	84.4	83	3	120.6	80.6	121.4	81.1		
4	116.5	86.4	117.3	87.0	118.1	87.6	118.9	88.2	119.7	88.8	120.5	89.4	121.3	90.0	122.1	90.5	84	4	116.5	86.4	117.3	87.0		
	112.1	92.0	112.9	92.6	113.6	93.3	114.4	93.9	115.2	94.5	115.9	95.2	116.7	95.8	117.5	96.4	85	4	112.1	92.0	112.9	92.6		
	107.4	97.4	108.2	98.0	108.9	98.7	109.7	99.4	110.4	100.1	111.1	100.7	111.9	101.4	112.6	102.1	86	4	107.4	97.4	108.2	98.0		
	102.5	102.5	103.2	103.2	103.9	103.9	104.7	104.7	105.4	105.4	106.1	106.1	106.8	106.8	107.5	107.5	87	4	102.5	102.5	103.2	103.2		
1°	145.0	02.5	146.0	02.5	147.0	02.6	148.0	02.6	149.0	02.6	150.0	02.6	151.0	02.6	152.0	02.7	89°							
2	144.9	05.1	145.9	05.1	146.9	05.1	147.9	05.2	148.9	05.2	149.9	05.2	150.9	05.3	151.9	05.3	88							
3	144.8	07.6	145.8	07.6	146.8	07.7	147.8	07.7	148.8	07.8	149.8	07.9	150.8	07.9	151.8	08.0	87							
4	144.6	10.1	145.6	10.2	146.6	10.3	147.6	10.3	148.6	10.4	149.6	10.5	150.6	10.5	151.6	10.6	86							
5	144.4	12.6	145.4	12.7	146.4	12.8	147.4	12.9	148.4	13.0	149.4	13.1	150.4	13.2	151.4	13.2	85							
6	144.2	15.2	145.2	15.3	146.2	15.4	147.2	15.5	148.2	15.6	149.2	15.7	150.2	15.8	151.2	15.9	84							
7	143.9	17.7	144.9	17.8	145.9	17.9	146.9	18.0	147.9	18.2	148.9	18.3	149.9	18.4	150.9	18.5	83							
8	143.6	20.2	144.6	20.3	145.6	20.5	146.6	20.6	147.5	20.7	148.5	20.9	149.5	21.0	150.5	21.2	82							
9	143.2	22.7	144.2	22.8	145.2	23.0	146.2	23.2	147.2	23.3	148.2	23.5	149.1	23.6	150.1	23.8	81							
10	142.8	25.2	143.8	25.4	144.8	25.5	145.8	25.7	146.7	25.9	147.7	26.0	148.7	26.2	149.7	26.4	80							
11	142.3	27.7	143.3	27.9	144.3	28.0	145.3	28.2	146.3	28.4	147.2	28.6	148.2	28.8	149.2	29.0	79							
12	141.8	30.1	142.8	30.4	143.8	30.6	144.8	30.8	145.7	31.0	146.7	31.2	147.7	31.4	148.7	31.6	78							
13	141.3	32.6	142.3	32.8	143.3	33.1	144.2	33.3	145.2	33.5	146.2	33.7	147.1	34.0	148.1	34.2	77							
14	140.7	35.1	141.7	35.3	142.6	35.6	143.6	35.8	144.6	36.0	145.5	36.3	146.5	36.5	147.5	36.8	76							
15	140.1	37.5	141.0	37.8	142.0	38.0	143.0	38.3	143.9	38.6	144.9	38.8	145.9	39.1	146.8	39.3	75							
16	139.4	40.0	140.3	40.2	141.3	40.5	142.3	40.8	143.2	41.1	144.2	41.3	145.2	41.6	146.1	41.9	74							
17	138.7	42.4	139.6	42.7	140.6	43.0	141.5	43.3	142.5	43.6	143.4	43.9	144.4	44.1	145.4	44.4	73							
18	137.9	44.8	138.9	45.1	139.8	45.4	140.8	45.7	141.7	46.0	142.7	46.4	143.6	46.7	144.6	47.0	72							
19	137.1	47.2	138.0	47.5	139.0	47.9	139.9	48.2	140.9	48.5	141.8	48.8	142.8	49.2	143.7	49.5	71							
20	136.3	49.6	137.2	49.9	138.1	50.3	139.1	50.6	140.0	51.0	141.0	51.3	141.9	51.6	142.8	52.0	70							
21	135.4	52.0	136.3	52.3	137.2	52.7	138.2	53.0	139.1	53.4	140.0	53.8	141.0	54.1	141.9	54.5	69							
22	134.4	54.3	135.4	54.7	136.3	55.1	137.2	55.4	138.2	55.8	139.1	56.2	140.0	56.6	140.9	56.9	68							
23	133.5	56.7	134.4	57.0	135.3	57.4	136.2	57.8	137.2	58.2	138.1	58.6	139.0	59.0	139.9	59.4	67							
24	132.5	59.0	133.4	59.4	134.3	59.8	135.2	60.2	136.1	60.6	137.0	61.0	137.9	61.4	138.9	61.8	66							
25	131.4	61.3	132.3	61.7	133.2	62.1	134.1	62.5	135.0	63.0	135.9	63.4	136.9	63.8	137.8	64.2	65							
26	130.3	63.6	131.2	64.0	132.1	64.4	133.0	64.9	133.9	65.3	134.8	65.8	135.7	66.2	136.6	66.6	64							
27	129.2	65.8	130.1	66.3	131.0	66.7	131.9	67.2	132.8	67.6	133.7	68.1	134.5	68.6	135.4	69.0	63							
28	128.0	68.1	128.9	68.5	129.8	69.0	130.7	69.5	131.6	70.0	132.4	70.4	133.3	70.9	134.2	71.4	62							
29	126.8	70.3	127.7	70.8	128.6	71.3	129.4	71.8	130.3	72.2	131.2	72.7	132.1	73.2	132.9	73.7	61							
30	125.6	72.5	126.4	73.0	127.3	73.5	128.2	74.0	129.0	74.5	129.9	75.0	130.8	75.5	131.6	76.0	60							
31	124.3	74.7	125.1	75.2	126.0	75.7	126.9	76.2	127.7	76.7	128.6	77.3	129.4	77.8	130.3	78.3	59							
32	123.0	76.8	123.8	77.4	124.7	77.9	125.5	78.4	126.4	79.0	127.2	79.5	128.1	80.0	128.9	80.5	58							
33	121.6	79.0	122.4	79.5	123.3	80.1	124.1	80.6	125.0	81.2	125.8	81.7	126.6	82.2	127.5	82.8	57							
34	120.2	81.1	121.0	81.6	121.9	82.2	122.7	82.8	123.5	83.3	124.4	83.9	125.2	84.4	126.0	85.0	56							
35	118.8	83.2	119.6	83.7	120.4	84.3	121.2	84.9	121.1	85.5	122.9	86.0	123.7	86.6	124.5	87.2	55							
36	117.3	85.2	118.1	85.8	118.9	86.4	119.7	87.0	120.5	87.6	121.4	88.2	122.2	88.8	123.0	89.3	54							
37	115.8	87.3	116.6	87.9	117.4	88.5	118.2	89.1	119.0	89.7	119.8	90.3	120.0	90.9	121.4	91.5	53							
38	114.3	89.3	115.0	89.9	115.8	90.5	116.6	91.1	117.4	91.7	118.2	92.3	119.0	93.0	119.8	93.6	52							
39	112.7	91.3	113.5	91.9	114.2	92.5	115.0	93.1	115.8	93.8	116.6	94.4	117.3	95.0	118.1	95.7	51							
40	111.1	93.2	111.8	93.8	112.6	94.5	113.4	95.1	114.1	95.8	114.9	96.4	115.7	97.1	116.4	97.7	50							
41	109.4	95.1	110.2	95.8	110.9	96.4	111.7	97.1	112.5	97.8	113.2	98.4	114.0	99.1	114.7	99.7	49							
42	107.8	97.0	108.5	97.7	109.2	98.4	110.0	99.0	110.7	99.7	111.5	100.4	112.2	101.0	113.0	101.7	48							
43	106.0	98.9	106.8	99.6	107.5	100.3	103.2	100.9	109.0	101.6	109.7	102.3	110.4	103.0	111.2	103.7	47							
44	104.3	100.7	105.0	101.4	105.7	102.1	106.5	102.8	107.2	103.5	107.9	104.2	108.6	104.9	109.3	105.6	46							
45	102.5	102.5	103.2	103.2	103.9	103.9	104.7	104.7	105.4	105.4	106.1	106.1	106.8	106.8	107.5	107.5	45							
Crse.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Crse.							

Traverse Table.

(x.)

Distance. 153		154		155		156		157		158		159		160	
Crs.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crs.
1	152.8 07.5 153.8	07.6 154.8	07.6 155.8	07.7 156.8	07.7 157.8	07.8 158.8	07.8 159.8	07.9 160.8	07.9 161.8	08.0 162.8	08.0 163.8	08.1 164.8	08.1 165.8	08.2 166.8	08.2 167.8
2	152.3 15.0 153.3	15.1 154.3	15.2 155.3	15.3 156.3	15.4 157.3	15.5 158.3	15.6 159.3	15.7 160.3	15.8 161.3	15.9 162.3	16.0 163.3	16.1 164.3	16.2 165.3	16.3 166.3	16.4 167.3
3	151.3 22.4 152.3	22.6 153.3	22.7 154.3	22.9 155.3	23.0 156.3	23.2 157.3	23.3 158.3	23.5 159.3	23.6 160.3	23.8 161.3	23.9 162.3	24.1 163.3	24.2 164.3	24.4 165.3	24.5 166.3
4	150.1 29.9 151.0	30.0 152.0	30.2 153.0	30.4 154.0	30.6 155.0	30.8 156.0	31.0 157.0	31.2 158.0	31.4 159.0	31.6 160.0	31.8 161.0	32.0 162.0	32.2 163.0	32.4 164.0	32.6 165.0
5	148.4 37.2 149.4	37.4 150.4	37.7 151.3	37.9 152.3	38.2 153.3	38.4 154.2	38.6 155.2	38.9 156.2	39.1 157.2	39.4 158.2	39.6 159.2	40.0 160.2	40.2 161.2	40.5 162.2	40.8 163.2
6	146.4 44.4 147.4	44.7 148.3	45.0 149.3	45.3 150.2	45.6 151.2	45.9 152.2	46.1 153.1	46.4 154.1	46.7 155.1	47.0 156.1	47.3 157.1	47.6 158.1	47.9 159.1	48.2 160.1	48.5 161.1
7	144.1 51.5 145.0	51.9 145.9	52.2 146.9	52.5 147.8	52.9 148.8	53.2 149.7	53.6 150.6	53.9 151.6	54.2 152.6	54.6 153.6	54.9 154.6	55.3 155.6	55.6 156.6	56.0 157.6	56.3 158.6
8	141.4 58.6 142.3	58.9 143.2	59.3 144.1	59.7 145.1	60.1 146.0	60.5 146.9	60.9 147.8	61.2 148.8	61.6 149.7	62.0 150.7	62.4 151.6	62.8 152.6	63.2 153.6	63.6 154.6	64.0 155.6
9	138.3 65.4 139.2	65.9 140.1	66.3 141.0	66.7 141.9	67.1 142.8	67.6 143.7	68.0 144.6	68.4 145.6	68.8 146.5	69.2 147.5	69.6 148.4	70.0 149.4	70.4 150.4	70.8 151.4	71.2 152.4
10	134.9 72.1 135.8	72.6 136.7	73.1 137.6	73.5 138.5	74.0 139.3	74.5 140.2	74.9 141.1	75.4 142.0	75.8 143.0	76.3 143.9	76.7 144.8	77.2 145.8	77.6 146.7	78.1 147.7	78.5 148.6
11	131.2 78.7 132.1	79.2 132.9	79.7 133.8	80.2 134.7	80.7 135.5	81.2 136.4	81.7 137.2	82.3 138.1	82.7 139.0	83.2 140.0	83.7 140.9	84.2 141.8	84.7 142.8	85.2 143.7	85.7 144.7
12	127.2 85.0 128.0	85.6 128.9	86.1 129.7	86.7 130.5	87.2 131.4	87.8 132.2	88.3 133.0	88.9 133.9	89.4 134.8	89.9 135.7	90.4 136.6	90.9 137.5	91.4 138.4	91.9 139.3	92.4 140.2
13	122.9 91.1 123.7	91.7 124.5	92.3 125.3	92.9 126.1	93.5 126.9	94.1 127.7	94.7 128.5	95.3 129.3	95.9 130.2	96.4 131.0	97.0 131.9	97.6 132.7	98.1 133.6	98.7 134.4	99.2 135.3
14	118.3 97.1 119.0	97.7 119.8	98.3 120.6	99.0 121.4	99.6 122.2	100.2 123.0	100.9 123.9	101.5 124.7	102.1 125.5	102.8 126.4	103.4 127.2	104.1 128.1	104.7 128.9	105.4 129.8	106.0 130.6
15	113.4 102.7 114.1	103.4 114.8	104.1 115.6	104.8 116.3	105.4 117.1	106.1 117.8	106.8 118.5	107.4 119.3	108.1 120.1	108.8 120.9	109.5 121.7	110.2 122.5	110.9 123.3	111.6 124.1	112.3 124.9
16	108.2 108.2 108.9	108.9 109.6	109.6 110.3	110.3 111.0	111.0 111.7	111.7 112.4	112.4 113.1	113.1 113.8	113.8 114.5	114.5 115.2	115.2 116.0	116.0 116.7	116.7 117.4	117.4 118.1	118.1 118.8
17	153.0 02.7 154.0	02.7 155.0	02.7 156.0	02.7 157.0	02.7 158.0	02.8 159.0	02.8 160.0	02.8 161.0	02.8 162.0	02.8 163.0	02.8 164.0	02.8 165.0	02.8 166.0	02.8 167.0	02.8 168.0
18	152.9 05.3 153.9	05.4 154.9	05.4 155.9	05.4 156.9	05.5 157.9	05.5 158.9	05.5 159.9	05.6 160.9	05.6 161.9	05.6 162.9	05.6 163.9	05.6 164.9	05.6 165.9	05.6 166.9	05.6 167.9
19	152.8 08.0 153.8	08.1 154.8	08.1 155.8	08.2 156.8	08.2 157.8	08.3 158.8	08.3 159.8	08.4 160.8	08.4 161.8	08.4 162.8	08.4 163.8	08.4 164.8	08.4 165.8	08.4 166.8	08.4 167.8
20	152.6 10.7 153.6	10.7 154.6	10.8 155.6	10.9 156.6	11.0 157.6	11.0 158.6	11.1 159.6	11.2 160.6	11.2 161.6	11.2 162.6	11.2 163.6	11.2 164.6	11.2 165.6	11.2 166.6	11.2 167.6
21	152.4 13.3 153.4	13.4 154.4	13.5 155.4	13.6 156.4	13.7 157.4	13.8 158.4	13.9 159.4	13.9 160.4	13.9 161.4	13.9 162.4	13.9 163.4	13.9 164.4	13.9 165.4	13.9 166.4	13.9 167.4
22	152.2 16.0 153.2	16.1 154.2	16.2 155.1	16.3 156.1	16.4 157.1	16.5 158.1	16.6 159.1	16.7 160.1	16.7 161.1	16.7 162.1	16.7 163.1	16.7 164.1	16.7 165.1	16.7 166.1	16.7 167.1
23	151.9 18.6 152.9	18.8 153.8	18.9 154.8	19.0 155.8	19.1 156.8	19.3 157.8	19.4 158.8	19.5 159.8	19.5 160.8	19.5 161.8	19.5 162.8	19.5 163.8	19.5 164.8	19.5 165.8	19.5 166.8
24	151.5 21.3 152.5	21.4 153.5	21.6 154.5	21.7 155.5	21.9 156.5	22.0 157.5	22.1 158.4	22.2 159.4	22.2 160.4	22.2 161.4	22.2 162.4	22.2 163.4	22.2 164.4	22.2 165.4	22.2 166.4
25	151.1 23.9 152.1	24.1 153.1	24.2 154.1	24.4 155.1	24.6 156.1	24.7 157.0	24.9 158.0	25.0 159.0	25.0 160.0	25.0 161.0	25.0 162.0	25.0 163.0	25.0 164.0	25.0 165.0	25.0 166.0
26	150.7 26.6 151.7	26.7 152.6	26.9 153.6	27.1 154.6	27.3 155.6	27.4 156.6	27.6 157.6	27.8 158.6	27.8 159.6	27.8 160.6	27.8 161.6	27.8 162.6	27.8 163.6	27.8 164.6	27.8 165.6
27	150.2 29.2 151.2	29.4 152.2	29.6 153.1	29.8 154.1	30.0 155.1	30.1 156.1	30.3 157.1	30.5 158.1	30.5 159.1	30.5 160.1	30.5 161.1	30.5 162.1	30.5 163.1	30.5 164.1	30.5 165.1
28	149.7 31.8 150.6	32.0 151.6	32.2 152.6	32.4 153.6	32.6 154.6	32.9 155.5	33.1 156.5	33.3 157.5	33.3 158.5	33.3 159.5	33.3 160.5	33.3 161.5	33.3 162.5	33.3 163.5	33.3 164.5
29	149.1 34.4 150.1	34.6 151.0	34.9 152.0	35.1 153.0	35.3 154.0	35.5 154.9	35.8 155.9	36.0 156.9	36.0 157.9	36.0 158.9	36.0 159.9	36.0 160.9	36.0 161.9	36.0 162.9	36.0 163.9
30	148.5 37.0 149.4	37.3 150.4	37.5 151.4	37.7 152.3	38.0 153.3	38.2 154.3	38.5 155.2	38.7 156.2	38.7 157.2	38.7 158.2	38.7 159.2	38.7 160.2	38.7 161.2	38.7 162.2	38.7 163.2
31	147.8 39.6 148.8	39.9 149.7	40.1 150.7	40.4 151.7	40.6 152.6	40.9 153.6	41.2 154.5	41.5 155.5	41.5 156.5	41.5 157.5	41.5 158.5	41.5 159.5	41.5 160.5	41.5 161.5	41.5 162.5
32	147.1 42.2 148.0	42.4 149.0	42.7 150.0	43.0 150.9	43.3 151.9	43.6 152.8	43.8 153.8	44.1 154.8	44.1 155.8	44.1 156.8	44.1 157.8	44.1 158.8	44.1 159.8	44.1 160.8	44.1 161.8
33	146.3 44.7 147.3	45.0 148.2	45.3 149.2	45.6 150.1	45.9 151.1	46.2 152.1	46.5 153.0	46.8 154.0	46.8 155.0	46.8 156.0	46.8 157.0	46.8 158.0	46.8 159.0	46.8 160.0	46.8 161.0
34	145.5 47.3 146.5	47.6 147.4	47.9 148.4	48.2 149.3	48.5 150.3	48.8 151.2	49.1 152.2	49.4 153.2	49.4 154.2	49.4 155.2	49.4 156.2	49.4 157.2	49.4 158.2	49.4 159.2	49.4 160.2
35	144.7 49.8 145.6	50.1 146.6	50.5 147.5	50.8 148.4	51.1 149.4	51.4 150.3	51.8 151.3	52.1 152.2	52.1 153.2	52.1 154.2	52.1 155.2	52.1 156.2	52.1 157.2	52.1 158.2	52.1 159.2
36	143.8 52.3 144.7	52.7 145.7	53.0 146.6	53.4 147.5	53.7 148.5	54.0 149.4	54.4 150.4	54.7 151.4	54.7 152.4	54.7 153.4	54.7 154.4	54.7 155.4	54.7 156.4	54.7 157.4	54.7 158.4
37	142.8 54.8 143.8	55.2 144.7	55.5 145.6	55.9 146.6	56.3 147.5	56.6 148.4	57.0 149.4	57.3 150.4	57.3 151.4	57.3 152.4	57.3 153.4	57.3 154.4	57.3 155.4	57.3 156.4	57.3 157.4
38	141.9 57.3 142.8	57.7 143.7	58.1 144.6	58.4 145.6	58.8 146.5	59.2 147.4	59.6 148.3	59.9 149.3	59.9 150.3	59.9 151.3	59.9 152.3	59.9 153.3	59.9 154.3	59.9 155.3	59.9 156.3
39	140.8 59.8 141.8	60.2 142.7	60.6 143.6	61.0 144.5	61.3 145.4	61.7 146.4	62.1 147.3	62.5 148.3	62.5 149.3	62.5 150.3	62.5 151.3	62.5 152.3	62.5 153.3	62.5 154.3	62.5 155.3
40	139.8 62.2 140.7	62.6 141.6	63.0 142.5	63.5 143.4	63.9 144.3	64.3 145.3	64.7 146.2	65.1 147.2	65.1 148.2	65.1 149.2	65.1 150.2	65.1 151.2	65.1 152.2	65.1 153.2	65.1 154.2
41	138.7 64.7 139.6	65.1 140.5	65.5 141.4	65.9 142.3	66.4 143.2	66.8 144.1	67.3 145.0	67.6 146.0	67.6 147.0	67.6 148.0	67.6 149.0	67.6 150.0	67.6 151.0	67.6 152.0	67.6 153.0
42	137.5 67.1 138.4	67.5 139.3	67.9 140.2	68.4 141.1	68.8 142.0	69.3 142.9	69.7 143.8	70.1 144.8	70.1 145.8	70.1 146.8	70.1 147.8	70.1 148.8	70.1 149.8	70.1 150.8	70.1 151.8
43	136.3 69.5 137.2	69.9 138.1	70.4 139.0	70.8 139.9	71.3 140.8	71.7 141.7	72.2 142.6	72.6 143.6	72.6 144.6	72.6 145.6	72.6 146.6	72.6 147.6	72.6 148.6	72.6 149.6	72.6 150.6
44	135.1 71.8 136.0	72.3 136.9	72.8 137.7	73.2 138.6	73.7 139.5	74.2 140.4	74.6 141.3	75.1 142.2	75.1 143.2	75.1 144.2	75.1 145.2	75.1 146.2	75.1 147.2	75.1 148.2	75.1 149.2
45	133.8 74.2 134.7	74.7 135.6	75.1 136.4	75.6 137.3	76.1 138.2	76.6 139.1	77.1 139.9	77.6 140.8	77.6 141.8	77.6 142.8	77.6 143.8	77.6 144.8	77.6 145.8	77.6 146.8	77.6 147.8
46	132.5 76.5 133.4	77.0 134.2	77.5 135.1	78.0 136.0	78.5 136.9	79.0 137.7	79.5 138.6	80.0 139.5	80.0 140.5	80.0 141.5	80.0 142.5	80.0 143.5	80.0 144.5	80.0 145.5	80.0 146.5
47	131.1 78.8 132.0	79.3 132.9	79.8 133.7	80.3 134.6	80.9 135.4	81.4 136.3	81.9 137.2	82.4 138.1	82.4 139.1	82.4 140.1	82.4 141.1	82.4 142.1	82.4 143.1	82.4 144.1	82.4 145.1
48	129.8 81.1 130.6	81.6 131.4	82.1 132.3	82.7 133.1	83.2 134.0	83.7 134.8	84.3 135.7	84.8 136.6	84.8 137.6	84.8 138.6	84.8 139.6	84.8 140.6	84.8 141.6	84.8 142.6	84.8 143.6
49	128.3 83.3 129.2	83.9 130.0	84.4 130.8	85.0 131.7	85.5 132.5	86.1 133.3	86.6 134.2	87.							

Traverse Table.

(x.)

Distance. 161			162			163			164			165			166			167			168		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.		
1	160.8	07.9	161.8	08.0	162.8	08.0	163.8	08.1	164.8	08.1	165.8	08.2	166.8	08.2	167.8	08.2	2	167.8	08.2	168.8	08.2	169.8	
	160.2	15.8	161.2	15.9	162.2	16.0	163.2	16.1	164.2	16.2	165.2	16.3	166.2	16.4	167.2	16.5		170.8					
	159.3	23.4	160.3	23.8	161.2	23.9	162.2	24.1	163.2	24.2	164.2	24.4	165.2	24.5	166.2	24.6		171.8					
	157.9	31.4	158.9	31.6	159.9	31.8	160.8	32.0	161.8	32.2	162.8	32.4	163.8	32.6	164.8	32.8		172.8					
	156.2	39.1	157.1	39.4	158.1	39.6	159.1	39.9	160.1	40.1	161.0	40.3	162.0	40.6	163.0	40.8		173.8					
2	154.1	46.7	155.0	47.0	156.0	47.3	156.9	47.6	157.9	47.9	158.9	48.2	159.8	48.5	160.8	48.8	3	160.8	48.8	161.8	48.8	162.8	
	151.6	54.2	152.5	54.6	153.5	54.9	154.4	55.2	155.3	55.6	156.3	55.9	157.2	56.3	158.2	56.6		163.8					
	148.7	61.6	149.7	62.0	150.6	62.4	151.5	62.8	152.4	63.1	153.4	63.5	154.3	63.9	155.2	64.3		164.8					
	145.5	68.8	146.4	69.3	147.3	69.7	148.3	70.1	149.2	70.6	150.1	71.0	151.0	71.4	151.9	71.8		165.3					
	142.0	75.9	142.9	76.4	143.8	76.8	144.6	77.3	145.5	77.8	146.4	78.2	147.3	78.7	148.2	79.2		166.3					
3	138.1	82.8	138.9	83.3	139.8	83.8	140.7	84.3	141.5	84.8	142.4	85.3	143.2	85.8	144.1	86.4	4	166.3	86.4	167.3	86.4	168.3	
	133.9	89.4	134.7	90.0	135.5	90.6	136.4	91.1	137.2	91.7	138.0	92.2	138.9	92.8	139.7	93.3		169.3					
	129.3	95.9	130.1	96.5	130.9	97.1	131.7	97.7	132.5	98.3	133.3	98.9	134.1	99.5	134.9	100.1		170.3					
	124.4	102.1	125.2	102.8	126.0	103.4	126.8	104.0	127.5	104.7	128.3	105.3	129.1	105.9	129.9	106.6		171.3					
	119.3	108.1	120.0	108.8	120.8	109.5	121.5	110.1	122.3	110.8	123.0	111.5	123.7	112.1	124.5	112.8		172.3					
4	113.8	113.8	114.5	114.5	115.3	115.3	116.0	116.0	116.7	116.7	117.4	117.4	118.1	118.1	118.8	118.8	173.3						
1°	161.0	02.8	162.0	02.8	163.0	02.8	164.0	02.9	165.0	02.9	166.0	02.9	167.0	02.9	168.0	02.9	89°						
2	160.9	05.6	161.9	05.7	162.9	05.7	163.9	05.7	164.9	05.8	165.9	05.8	166.9	05.8	167.9	05.8	90						
3	160.8	08.4	161.8	08.5	162.8	08.5	163.8	08.6	164.8	08.6	165.8	08.7	166.8	08.7	167.8	08.7	91						
4	160.6	11.2	161.6	11.3	162.6	11.4	163.6	11.4	164.6	11.5	165.6	11.6	166.6	11.6	167.6	11.7	92						
5	160.4	14.0	161.4	14.1	162.4	14.2	163.4	14.3	164.4	14.4	165.4	14.5	166.4	14.6	167.4	14.6	93						
6	160.1	16.8	161.1	16.9	162.1	17.0	163.1	17.1	164.1	17.2	165.1	17.4	166.1	17.5	167.1	17.6	94						
7	159.8	19.6	160.8	19.7	161.8	19.9	162.8	20.0	163.8	20.1	164.8	20.2	165.8	20.4	166.7	20.5	95						
8	159.4	22.4	160.4	22.5	161.4	22.7	162.4	22.8	163.4	23.0	164.4	23.1	165.4	23.2	166.4	23.4	96						
9	159.0	25.2	160.0	25.3	161.0	25.5	162.0	25.7	163.0	25.8	164.0	26.0	164.9	26.1	165.9	26.3	97						
10	158.6	28.0	159.5	28.1	160.5	28.3	161.5	28.5	162.5	28.7	163.5	28.8	164.5	29.0	165.4	29.2	98						
11	158.0	30.7	159.0	30.9	160.0	31.1	161.0	31.3	162.0	31.5	163.0	31.7	163.9	31.9	164.9	32.1	99						
12	157.5	33.5	158.5	33.7	159.4	33.9	160.4	34.1	161.4	34.3	162.4	34.5	163.4	34.7	164.3	34.9	78						
13	156.9	36.2	157.8	36.4	158.8	36.7	159.8	36.9	160.8	37.1	161.7	37.3	162.7	37.6	163.7	37.8	77						
14	156.2	38.9	157.2	39.2	158.2	39.4	159.1	39.7	160.1	39.9	161.1	40.2	162.0	40.4	163.0	40.6	76						
15	155.5	41.7	156.5	41.9	157.4	42.2	158.4	42.4	159.4	42.7	160.3	43.0	161.3	43.2	162.3	43.5	75						
16	154.8	44.4	155.7	44.7	156.7	44.9	157.6	45.2	158.6	45.5	159.6	45.8	160.5	46.0	161.5	46.3	74						
17	154.0	47.1	154.9	47.4	155.9	47.7	156.8	47.9	157.8	48.2	158.7	48.5	159.7	48.8	160.7	49.1	73						
18	153.1	49.8	154.1	50.1	155.0	50.4	156.0	50.7	156.9	51.0	157.9	51.3	158.8	51.6	159.8	51.9	72						
19	152.2	52.4	153.2	52.7	154.1	53.1	155.1	53.4	156.0	53.7	157.0	54.0	157.9	54.4	158.8	54.7	71						
20	151.3	55.1	152.2	55.4	153.2	55.7	154.1	56.1	155.0	56.4	156.0	56.8	156.9	57.1	157.9	57.5	70						
21	150.3	57.7	151.2	58.1	152.2	58.4	153.1	58.8	154.0	59.1	155.0	59.5	155.9	59.8	156.8	60.2	69						
22	149.3	60.3	150.2	60.7	151.1	61.1	152.1	61.4	153.0	61.8	153.9	62.2	154.8	62.6	155.8	62.9	68						
23	148.2	62.9	149.1	63.3	150.0	63.7	151.0	64.1	151.9	64.5	152.8	64.9	153.7	65.3	154.6	65.6	67						
24	147.1	65.5	148.0	65.9	148.9	66.3	149.8	66.7	150.7	67.1	151.6	67.5	152.6	67.9	153.5	68.3	66						
25	145.9	68.0	146.8	68.5	147.7	68.9	148.6	69.3	149.5	69.7	150.4	70.2	151.4	70.6	152.3	71.0	65						
26	144.7	70.6	145.6	71.0	146.5	71.5	147.4	71.9	148.3	72.3	149.2	72.8	150.1	73.2	151.0	73.6	64						
27	143.5	73.1	144.3	73.5	145.2	74.0	146.1	74.5	147.0	74.9	147.9	75.4	148.8	75.8	149.7	76.3	63						
28	142.2	75.6	143.0	76.1	143.9	76.5	144.8	77.0	145.7	77.5	146.6	77.9	147.5	78.4	148.3	78.9	62						
29	140.8	78.1	141.7	78.5	142.6	79.0	143.4	79.5	144.3	80.0	145.2	80.5	146.1	81.0	146.9	81.4	61						
30	139.4	80.5	140.3	81.0	141.2	81.5	142.0	82.0	142.9	82.5	143.8	83.0	144.6	83.5	145.5	84.0	60						
31	138.0	82.9	138.9	83.4	139.7	84.0	140.6	84.5	141.4	85.0	142.3	85.5	143.1	86.0	144.0	86.5	59						
32	136.5	85.3	137.4	85.8	138.2	86.4	139.1	86.9	139.9	87.4	140.8	88.0	141.6	88.5	142.5	89.0	58						
33	135.0	87.7	135.9	88.2	136.7	88.8	137.5	89.3	138.4	89.9	139.2	90.4	140.1	91.0	140.9	91.5	57						
34	133.5	90.0	134.3	90.6	135.1	91.1	136.0	91.7	136.8	92.3	137.6	92.8	138.4	93.4	139.3	93.9	56						
35	131.9	92.3	132.7	92.9	133.5	93.5	134.3	94.1	135.2	94.6	136.0	95.2	136.8	95.8	137.6	96.4	55						
36	130.3	94.6	131.1	95.2	131.9	95.8	132.7	96.4	133.5	97.0	134.3	97.6	135.1	98.2	135.9	98.7	54						
37	128.6	96.9	129.4	97.5	130.2	98.1	131.0	98.7	131.8	99.3	132.6	99.9	133.4	100.5	134.2	101.1	53						
38	126.9	99.1	127.7	99.7	128.4	100.4	129.2	101.0	130.0	101.6	130.8	102.2	131.6	102.8	132.4	103.4	52						
39	125.1	101.3	125.9	101.9	126.7	102.6	127.5	103.2	128.2	103.8	129.0	104.5	129.8	105.1	130.6	105.7	51						
40	123.3	103.5	124.1	104.1	124.9	104.8	125.6	105.4	126.4	106.1	127.2	106.7	127.9	107.3	128.7	108.0	50						
41	121.5	105.6	122.3	106.3	123.0	106.9	123.8	107.6	124.5	108.2	125.3	108.9	126.0	109.6	126.8	110.2	49						
42	119.6	107.7	120.4	108.4	121.1	109.1	121.9	109.7	122.6	110.4	123.4	111.1	124.1	111.7	124.8	112.4	48						
43	117.7	109.8	118.5	110.5	119.2	111.2	119.9	111.8	120.7	112.5	121.4	113.2	122.1	113.9	122.9	114.6	47						
44	115.8	111.8	116.5	112.5	117.3	113.2	118.0	113.9	118.7	114.6	119.4	115.3	120.1	116.0	120.8	116.7	46						
45	113.8	113.8	114.6	114.6	115.3	115.3	116.0	116.0	116.7	116.7	117.4	117.4	118.1	118.1	118.8	118.8	45						
Crs.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Crs.						

Traverse Table.

(x.)

Distance. 169			170			171			172			173			174			175			176			Crse.
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse.			
1 李 李 李 李	168.8	08.3	169.8	08.3	170.8	08.4	171.8	08.4	172.8	08.5	173.8	08.5	174.8	08.6	175.8	08.6	176.8	08.6	177.8	08.6	7			
	168.2	16.6	169.2	16.7	170.2	16.8	171.2	16.9	172.2	17.0	173.2	17.1	174.2	17.2	175.2	17.3	176.2	17.3	177.2	17.3	8			
	167.2	24.8	168.2	24.9	169.1	25.1	170.1	25.2	171.1	25.4	172.1	25.5	173.1	25.7	174.1	25.8	175.1	25.9	176.1	26.0	9			
	165.7	33.0	166.7	33.2	167.7	33.4	168.7	33.6	169.7	33.8	170.7	34.0	171.6	34.1	172.6	34.3	173.6	34.4	174.6	34.5	10			
	163.9	41.1	164.9	41.3	165.9	41.6	166.8	41.8	167.8	42.0	168.8	42.3	169.8	42.5	170.7	42.8	171.7	43.0	172.7	43.2	11			
2 李 李 李 李	161.7	49.1	162.7	49.3	163.6	49.6	164.6	49.9	165.6	50.2	166.5	50.5	167.5	50.8	168.4	51.1	169.4	51.3	170.4	51.6	12			
	159.1	56.9	160.1	57.3	161.0	57.6	161.9	57.9	162.9	58.3	163.8	58.6	164.8	59.0	165.7	59.3	166.7	59.6	167.7	59.9	13			
	156.1	64.7	157.1	65.1	158.0	65.4	158.9	65.8	159.8	66.2	160.8	66.6	161.7	67.0	162.6	67.4	163.6	67.7	164.6	68.1	14			
	152.8	72.3	153.7	72.7	154.6	73.1	155.5	73.6	156.4	74.0	157.3	74.4	158.2	74.8	159.1	75.3	160.1	75.6	161.1	76.0	15			
	149.0	79.7	149.9	80.1	150.8	80.6	151.7	81.1	152.6	81.5	153.5	82.0	154.4	82.5	155.2	83.0	156.2	83.5	157.2	84.0	16			
3 李 李 李 李	145.0	86.9	145.8	87.4	146.7	87.9	147.5	88.4	148.4	88.9	149.2	89.4	150.1	90.0	151.0	90.5	152.0	91.0	152.0	91.5	17			
	140.5	93.9	141.3	94.4	142.2	95.0	143.0	95.6	143.8	96.1	144.7	96.7	145.5	97.2	146.3	97.8	147.2	98.2	148.2	98.7	18			
	135.7	100.7	136.5	101.3	137.3	101.9	138.1	102.5	138.9	103.1	139.8	103.7	140.6	104.2	141.4	104.8	142.2	105.2	143.2	105.7	19			
	130.6	107.2	131.4	107.8	132.2	108.5	133.0	109.1	133.7	109.7	134.5	110.4	135.3	111.0	136.0	111.6	136.8	112.5	137.8	113.5	20			
	125.2	113.5	126.0	114.2	126.7	114.8	127.4	115.5	128.2	116.2	128.9	116.8	129.7	117.5	130.4	118.2	131.2	119.0	131.8	120.0	21			
4	119.5	119.5	120.2	120.2	120.9	120.9	121.6	121.6	122.3	122.3	123.0	123.0	123.7	123.7	124.4	124.4	125.1	125.1	125.8	125.8	22			
10 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45	169.0	02.9	170.0	03.0	171.0	03.0	172.0	03.0	173.0	03.0	174.0	03.0	175.0	03.1	176.0	03.1	177.0	03.1	178.0	03.1	89			
	168.9	05.9	169.9	05.9	170.9	06.0	171.9	06.0	172.9	06.0	173.9	06.1	174.9	06.1	175.9	06.1	176.9	06.1	177.9	06.1	88			
	168.8	08.8	169.8	08.9	170.8	08.9	171.8	09.0	172.8	09.0	173.8	09.1	174.8	09.2	175.8	09.2	176.8	09.2	177.8	09.2	87			
	168.6	11.8	169.6	11.9	170.6	11.9	171.6	12.0	172.6	12.1	173.6	12.1	174.6	12.2	175.6	12.3	176.6	12.3	177.6	12.3	86			
	168.4	14.7	169.4	14.8	170.3	14.9	171.3	15.0	172.3	15.1	173.3	15.2	174.3	15.3	175.3	15.3	176.3	15.3	177.3	15.3	85			
	168.1	17.7	169.1	17.8	170.1	17.9	171.1	18.0	172.1	18.1	173.1	18.2	174.1	18.3	175.1	18.4	176.1	18.4	177.1	18.4	84			
	167.7	20.6	168.7	20.7	169.7	20.8	170.7	21.0	171.7	21.1	172.7	21.2	173.7	21.3	174.7	21.4	175.7	21.4	176.7	21.4	83			
	167.4	23.5	168.3	23.7	169.3	23.8	170.3	23.9	171.3	24.1	172.3	24.2	173.3	24.4	174.3	24.5	175.3	24.5	176.3	24.5	82			
	166.9	26.4	167.9	26.6	168.9	26.8	169.9	26.9	170.9	27.1	171.9	27.2	172.8	27.4	173.8	27.5	174.8	27.5	175.8	27.5	81			
	166.4	29.3	167.4	29.5	168.4	29.7	169.4	29.9	170.4	30.0	171.4	30.2	172.3	30.4	173.3	30.6	174.3	30.6	175.3	30.6	80			
	165.9	32.2	166.9	32.4	167.9	32.6	168.8	32.8	169.8	33.0	170.8	33.2	171.8	33.4	172.8	33.6	173.8	33.6	174.8	33.6	79			
	165.3	35.1	166.3	35.3	167.3	35.6	168.2	35.8	169.2	36.0	170.2	36.2	171.2	36.4	172.2	36.6	173.2	36.6	174.2	36.6	78			
	164.7	38.0	165.6	38.2	166.6	38.5	167.6	38.7	168.6	38.9	169.5	39.1	170.5	39.4	171.5	39.6	172.5	39.6	173.5	39.6	77			
	164.0	40.9	165.0	41.1	165.9	41.4	166.9	41.6	167.9	41.9	168.8	42.1	169.8	42.3	170.8	42.6	171.8	42.6	172.8	42.6	76			
	163.2	43.7	164.2	44.0	165.2	44.3	166.1	44.5	167.1	44.8	168.1	45.0	169.0	45.3	170.0	45.6	171.0	45.6	172.0	45.6	75			
	162.5	46.6	163.4	46.9	164.4	47.1	165.3	47.4	166.3	47.7	167.3	48.0	168.2	48.2	169.2	48.5	170.2	48.5	171.2	48.5	74			
	161.6	49.4	162.6	49.7	163.5	50.0	164.5	50.3	165.4	50.6	166.4	50.9	167.4	51.2	168.3	51.5	169.3	51.5	170.3	51.5	73			
	160.7	52.2	161.7	52.5	162.6	52.8	163.6	53.2	164.5	53.5	165.5	53.8	166.4	54.1	167.4	54.4	168.4	54.4	169.4	54.4	72			
	159.8	55.0	160.7	55.3	161.7	55.7	162.6	56.0	163.6	56.3	164.5	56.6	165.5	56.9	166.4	57.3	167.4	57.3	168.4	57.3	71			
	158.8	57.8	159.7	58.1	160.7	58.5	161.6	58.8	162.6	59.2	163.5	59.5	164.4	59.9	165.4	60.2	166.4	60.2	167.4	60.2	70			
	157.8	60.6	158.7	60.9	159.6	61.3	160.6	61.6	161.5	62.0	162.4	62.4	163.4	62.7	164.3	63.1	165.3	63.1	166.3	63.1	69			
	156.7	63.3	157.6	63.7	158.5	64.1	159.5	64.4	160.4	64.8	161.3	65.2	162.3	65.6	163.2	65.9	164.2	65.9	165.2	65.9	68			
	155.6	66.0	156.5	66.4	157.4	66.8	158.3	67.2	159.2	67.6	160.2	68.0	161.1	68.4	162.0	68.8	163.0	68.8	164.0	68.8	67			
154.4	68.7	155.3	69.1	156.2	69.6	157.1	70.0	158.0	70.4	159.0	70.8	159.9	71.2	160.8	71.6	161.8	71.6	162.8	71.6	66				
153.2	71.4	154.1	71.8	155.0	72.3	155.9	72.7	156.8	73.1	157.7	73.5	158.6	74.0	159.5	74.4	160.5	74.4	161.5	74.4	65				
151.9	74.1	152.8	74.5	153.7	75.0	154.6	75.4	155.5	75.8	156.4	76.3	157.3	76.7	158.2	77.2	159.2	77.2	160.2	77.2	64				
150.6	76.7	151.5	77.2	152.4	77.6	153.3	78.1	154.1	78.5	155.0	79.0	155.9	79.4	156.8	79.9	157.8	79.9	158.8	79.9	63				
149.2	79.3	150.1	79.8	151.0	80.3	151.9	80.7	152.7	81.2	153.6	81.7	154.5	82.2	155.4	82.6	156.4	82.6	157.4	82.6	62				
147.8	81.9	148.7	82.4	149.6	82.9	150.4	83.4	151.3	83.9	152.2	84.4	153.1	84.8	153.9	85.3	154.9	85.3	155.9	85.3	61				
146.4	84.5	147.2	85.0	148.1	85.5	149.0	86.0	149.8	86.5	150.7	87.0	151.6	87.5	152.4	88.0	153.4	88.0	154.4	88.0	60				
144.9	87.0	145.7	87.6	146.6	88.1	147.4	88.6	148.3	89.1	149.1	89.6	150.0	90.1	150.9	90.6	151.9	90.6	152.9	90.6	59				
143.3	89.6	144.2	90.1	145.0	90.6	145.9	91.1	146.7	91.7	147.6	92.2	148.4	92.7	149.3	93.3	150.3	93.3	151.3	93.3	58				
141.7	92.0	142.6	92.6	143.4	93.1	144.3	93.7	145.1	94.2	145.9	94.8	146.8	95.3	147.6	95.9	148.9	95.9	149.9	95.9	57				
140.1	94.5	140.9	95.1	141.8	95.6	142.6	96.2	143.4	96.7	144.3	97.3	145.1	97.9	145.9	98.4	147.4	98.4	148.4	98.4	56				
138.4	96.9	139.3	97.5	140.1	98.1	140.9	98.7	141.7	99.2	142.5	99.8	143.4	100.4	144.2	100.9	145.9	100.9	146.9	100.9	55				
136.7	99.3	137.5	99.9	138.3	100.5	139.2	101.1	140.0	101.7	140.8	102.3	141.6	102.9	142.4	103.5	143.9	103.5	144.4	103					

Traverse Table.

(x.)

Distance.		177		178		179		180		181		182		183		184		Crse Pts
Crse	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crse	
1	176.8 08.7	177.8 08.7	178.8 08.8	179.8 08.8	180.8 08.9	181.8 08.9	182.8 09.0	183.8 09.0	184.8 09.1	185.8 09.1	186.8 09.2	187.8 09.2	188.8 09.3	189.8 09.3	190.8 09.4	191.8 09.4	192.8 09.5	7
2	176.1 17.4	177.1 17.4	178.1 17.5	179.1 17.6	180.1 17.7	181.1 17.8	182.1 17.9	183.1 18.0	184.1 18.0	185.1 18.1	186.1 18.2	187.1 18.3	188.1 18.4	189.1 18.5	190.1 18.5	191.1 18.6	192.1 18.7	7
3	175.1 26.0	176.1 26.1	177.1 26.3	178.0 26.4	179.0 26.6	180.0 26.7	181.0 26.8	182.0 27.0	183.0 27.0	184.0 27.1	185.0 27.2	186.0 27.3	187.0 27.4	188.0 27.5	189.0 27.6	190.0 27.7	191.0 27.8	7
4	173.6 34.5	174.6 34.7	175.6 34.9	176.5 35.1	177.5 35.3	178.5 35.5	179.5 35.7	180.5 35.9	181.5 36.0	182.5 36.2	183.5 36.4	184.5 36.6	185.5 36.8	186.5 37.0	187.5 37.2	188.5 37.4	189.5 37.6	7
5	171.7 43.0	172.7 43.3	173.6 43.5	174.6 43.7	175.6 44.0	176.5 44.2	177.5 44.5	178.5 44.7	179.5 45.0	180.5 45.2	181.5 45.5	182.5 45.8	183.5 46.0	184.5 46.3	185.5 46.6	186.5 46.9	187.5 47.2	7
6	169.4 51.4	170.3 51.7	171.3 52.0	172.3 52.2	173.2 52.5	174.2 52.8	175.1 53.1	176.1 53.4	177.1 53.7	178.1 54.0	179.1 54.3	180.1 54.6	181.1 55.0	182.1 55.3	183.1 55.6	184.1 56.0	185.1 56.3	7
7	166.6 59.6	167.6 60.0	168.5 60.3	169.5 60.6	170.4 61.0	171.4 61.3	172.3 61.6	173.2 62.0	174.2 62.3	175.1 62.7	176.1 63.0	177.1 63.4	178.1 63.8	179.1 64.2	180.1 64.6	181.1 65.0	182.1 65.4	7
8	163.5 67.7	164.5 68.1	165.4 68.5	166.3 68.9	167.2 69.3	168.2 69.7	169.1 70.0	170.0 70.4	171.0 70.8	172.0 71.2	173.0 71.6	174.0 72.0	175.0 72.4	176.0 72.8	177.0 73.2	178.0 73.6	179.0 74.0	6
9	160.0 75.7	160.9 76.1	161.8 76.5	162.7 77.0	163.6 77.4	164.5 77.8	165.4 78.3	166.3 78.7	167.3 79.1	168.2 79.5	169.1 79.9	170.0 80.3	171.0 80.7	172.0 81.1	173.0 81.5	174.0 81.9	175.0 82.3	6
10	156.1 83.4	157.0 83.9	157.9 84.4	158.8 84.8	159.6 85.3	160.5 85.8	161.4 86.3	162.3 86.7	163.3 87.1	164.2 87.6	165.1 88.0	166.0 88.5	167.0 88.9	168.0 89.3	169.0 89.8	170.0 90.2	171.0 90.6	6
11	151.8 91.0	152.7 91.5	153.5 92.0	154.4 92.5	155.3 93.0	156.1 93.6	157.0 94.1	157.8 94.6	158.8 95.0	159.7 95.5	160.6 96.0	161.5 96.5	162.4 97.0	163.3 97.5	164.2 98.0	165.1 98.5	166.0 99.0	6
12	147.2 98.3	148.0 98.9	148.8 99.4	149.7 100.0	150.5 100.6	151.3 101.1	152.2 101.7	153.0 102.2	153.9 102.8	154.7 103.3	155.6 103.9	156.4 104.4	157.3 105.0	158.1 105.5	159.0 106.0	160.0 106.6	160.8 107.1	5
13	142.2 105.4	143.0 106.0	143.8 106.6	144.6 107.2	145.4 107.8	146.2 108.4	147.0 109.0	147.8 109.6	148.7 110.2	149.5 110.8	150.3 111.4	151.1 112.0	151.9 112.6	152.7 113.2	153.5 113.8	154.3 114.4	155.1 115.0	5
14	136.8 112.3	137.6 112.9	138.4 113.6	139.1 114.2	139.9 114.8	140.7 115.5	141.5 116.1	142.2 116.7	143.0 117.3	143.8 118.0	144.6 118.6	145.4 119.3	146.2 119.9	147.0 120.5	147.8 121.2	148.6 121.8	149.4 122.4	5
15	131.1 118.9	131.9 119.5	132.6 120.2	133.4 120.9	134.1 121.5	134.8 122.2	135.6 122.9	136.3 123.6	137.1 124.2	137.9 124.9	138.7 125.6	139.5 126.3	140.3 127.0	141.1 127.7	141.9 128.4	142.7 129.1	143.5 129.8	5
16	125.2 125.2	125.9 125.9	126.6 126.6	127.3 127.3	128.0 128.0	128.7 128.7	129.4 129.4	130.1 130.1	130.8 130.8	131.5 131.5	132.2 132.2	132.9 132.9	133.6 133.6	134.3 134.3	135.0 135.0	135.7 135.7	136.4 136.4	4
17	177.0 03.1	178.0 03.1	179.0 03.1	180.0 03.1	181.0 03.2	182.0 03.2	183.0 03.2	184.0 03.2	185.0 03.2	186.0 03.2	187.0 03.2	188.0 03.2	189.0 03.2	190.0 03.2	191.0 03.2	192.0 03.2	193.0 03.2	89°
18	176.9 06.2	177.9 06.2	178.9 06.2	179.9 06.3	180.9 06.3	181.9 06.4	182.9 06.4	183.9 06.4	184.9 06.4	185.9 06.4	186.9 06.4	187.9 06.4	188.9 06.4	189.9 06.4	190.9 06.4	191.9 06.4	192.9 06.4	88
19	176.8 09.3	177.8 09.3	178.8 09.4	179.8 09.4	180.8 09.5	181.8 09.5	182.7 09.6	183.7 09.6	184.7 09.6	185.7 09.6	186.7 09.6	187.7 09.6	188.7 09.6	189.7 09.6	190.7 09.6	191.7 09.6	192.7 09.6	87
20	176.6 12.3	177.6 12.4	178.6 12.5	179.6 12.6	180.6 12.6	181.6 12.7	182.6 12.8	183.6 12.8	184.6 12.8	185.6 12.8	186.6 12.8	187.6 12.8	188.6 12.8	189.6 12.8	190.6 12.8	191.6 12.8	192.6 12.8	86
21	176.3 15.4	177.3 15.5	178.3 15.6	179.3 15.7	180.3 15.8	181.3 15.9	182.3 15.9	183.3 16.0	184.3 16.0	185.3 16.0	186.3 16.0	187.3 16.0	188.3 16.0	189.3 16.0	190.3 16.0	191.3 16.0	192.3 16.0	85
22	176.0 18.5	177.0 18.6	178.0 18.7	179.0 18.8	180.0 18.9	181.0 18.9	182.0 19.0	183.0 19.2	184.0 19.2	185.0 19.2	186.0 19.2	187.0 19.2	188.0 19.2	189.0 19.2	190.0 19.2	191.0 19.2	192.0 19.2	84
23	175.7 21.6	176.7 21.7	177.7 21.8	178.7 21.9	179.7 22.1	180.6 22.2	181.6 22.3	182.6 22.4	183.6 22.4	184.6 22.4	185.6 22.4	186.6 22.4	187.6 22.4	188.6 22.4	189.6 22.4	190.6 22.4	191.6 22.4	83
24	175.3 24.6	176.3 24.8	177.3 24.9	178.2 25.1	179.2 25.2	180.2 25.3	181.2 25.5	182.2 25.6	183.2 25.6	184.2 25.6	185.2 25.6	186.2 25.6	187.2 25.6	188.2 25.6	189.2 25.6	190.2 25.6	191.2 25.6	82
25	174.8 27.7	175.8 27.8	176.8 28.0	177.8 28.2	178.8 28.3	179.8 28.5	180.7 28.6	181.7 28.8	182.7 28.8	183.7 28.8	184.7 28.8	185.7 28.8	186.7 28.8	187.7 28.8	188.7 28.8	189.7 28.8	190.7 28.8	81
26	174.3 30.7	175.3 30.9	176.3 31.1	177.3 31.3	178.3 31.4	179.2 31.6	180.2 31.8	181.2 32.0	182.2 32.0	183.2 32.0	184.2 32.0	185.2 32.0	186.2 32.0	187.2 32.0	188.2 32.0	189.2 32.0	190.2 32.0	80
27	173.7 33.8	174.7 34.0	175.7 34.2	176.7 34.3	177.7 34.5	178.7 34.7	179.6 34.9	180.6 35.1	181.6 35.1	182.6 35.1	183.6 35.1	184.6 35.1	185.6 35.1	186.6 35.1	187.6 35.1	188.6 35.1	189.6 35.1	79
28	173.1 36.8	174.1 37.0	175.1 37.2	176.1 37.4	177.0 37.6	178.0 37.8	179.0 38.0	180.0 38.3	181.0 38.3	182.0 38.3	183.0 38.3	184.0 38.3	185.0 38.3	186.0 38.3	187.0 38.3	188.0 38.3	189.0 38.3	78
29	172.5 39.8	173.4 40.0	174.4 40.3	175.4 40.5	176.4 40.6	177.3 40.7	178.3 40.9	179.3 41.2	180.3 41.2	181.3 41.2	182.3 41.2	183.3 41.2	184.3 41.2	185.3 41.2	186.3 41.2	187.3 41.2	188.3 41.2	77
30	171.7 42.8	172.7 43.1	173.7 43.3	174.7 43.5	175.6 43.7	176.6 43.8	177.6 44.0	178.6 44.3	179.6 44.3	180.6 44.3	181.6 44.3	182.6 44.3	183.6 44.3	184.6 44.3	185.6 44.3	186.6 44.3	187.6 44.3	76
31	171.0 45.8	171.9 46.1	172.9 46.3	173.9 46.6	174.8 46.8	175.8 47.1	176.8 47.3	177.8 47.6	178.8 47.6	179.8 47.6	180.8 47.6	181.8 47.6	182.8 47.6	183.8 47.6	184.8 47.6	185.8 47.6	186.8 47.6	75
32	170.1 48.8	171.1 49.1	172.1 49.3	173.0 49.6	174.0 49.9	174.9 50.2	175.9 50.4	176.9 50.7	177.9 50.7	178.9 50.7	179.9 50.7	180.9 50.7	181.9 50.7	182.9 50.7	183.9 50.7	184.9 50.7	185.9 50.7	74
33	169.3 51.7	170.2 52.0	171.2 52.3	172.1 52.6	173.1 52.9	174.0 53.2	175.0 53.5	176.0 53.8	177.0 53.8	178.0 53.8	179.0 53.8	180.0 53.8	181.0 53.8	182.0 53.8	183.0 53.8	184.0 53.8	185.0 53.8	73
34	168.3 54.7	169.3 55.0	170.2 55.3	171.2 55.6	172.1 55.9	173.1 56.2	174.0 56.6	175.0 56.9	176.0 56.9	177.0 56.9	178.0 56.9	179.0 56.9	180.0 56.9	181.0 56.9	182.0 56.9	183.0 56.9	184.0 56.9	72
35	167.4 57.6	168.3 58.0	169.2 58.3	170.2 58.6	171.1 58.9	172.1 59.3	173.0 59.6	174.0 59.9	175.0 59.9	176.0 59.9	177.0 59.9	178.0 59.9	179.0 59.9	180.0 59.9	181.0 59.9	182.0 59.9	183.0 59.9	71
36	166.3 60.5	167.3 60.9	168.2 61.2	169.1 61.6	170.1 61.9	171.0 62.2	172.0 62.6	173.0 62.9	174.0 62.9	175.0 62.9	176.0 62.9	177.0 62.9	178.0 62.9	179.0 62.9	180.0 62.9	181.0 62.9	182.0 62.9	70
37	165.2 63.4	166.2 63.8	167.1 64.1	168.0 64.5	169.0 64.9	169.9 65.2	170.8 65.6	171.8 65.9	172.8 65.9	173.8 65.9	174.8 65.9	175.8 65.9	176.8 65.9	177.8 65.9	178.8 65.9	179.8 65.9	180.8 65.9	69
38	164.1 66.3	165.0 66.7	166.0 67.1	166.9 67.4	167.8 67.8	168.7 68.2	169.7 68.6	170.6 68.9	171.6 68.9	172.6 68.9	173.6 68.9	174.6 68.9	175.6 68.9	176.6 68.9	177.6 68.9	178.6 68.9	179.6 68.9	68
39	162.9 69.2	163.8 69.6	164.8 69.9	165.7 70.3	166.6 70.7	167.5 71.1	168.5 71.5	169.4 71.9	170.4 71.9	171.4 71.9	172.4 71.9	173.4 71.9	174.4 71.9	175.4 71.9	176.4 71.9	177.4 71.9	178.4 71.9	67
40	161.7 72.0	162.6 72.4	163.5 72.8	164.4 73.2	165.4 73.6	166.3 74.0	167.2 74.4	168.1 74.8	169.1 74.8	170.1 74.8	171.1 74.8	172.1 74.8	173.1 74.8	174.1 74.8	175.1 74.8	176.1 74.8	177.1 74.8	66
41	160.4 74.8	161.3 75.2	162.2 75.6	163.1 76.1	164.0 76.5	164.9 76.9	165.9 77.3	166.8 77.8	167.8 77.8	168.8 77.8	169.8 77.8	170.8 77.8	171.8 77.8	172.8 77.8	173.8 77.8	174.8 77.8	175.8 77.8	65
42	159.1 77.6	160.0 78.0	160.9 78.5	161.8 78.9	162.7 79.3	163.6 79.8	164.5 80.2	165.4 80.7	166.4 80.7	167.4 80.7	168.4 80.7	169.4 80.7	170.4 80.7	171.4 80.7	172.4 80.7	173.4 80.7	174.4 80.7	64
43	157.7 80.4	158.6 80.8	159.5 81.3	160.4 81.7	161.3 82.2	162.2 82.6	163.1 83.1	163.9 83.5	164.9 83.5	165.9 83.5	166.9 83.5	167.9 83.5	168.					

Traverse Table.

(x.)

Distance.		185	186	187	188	189	190	191	192		
Crs.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Crs.	Diff. Lat. | Dep.
1	184.8 09.1 185.8 09.1	186.8 09.2 187.8 09.2	188.8 09.3 189.8 09.3	190.8 09.4 191.8 09.4	192.8 09.5 193.8 09.5	194.8 09.6 195.8 09.6	196.8 09.7 197.8 09.7	198.8 09.8 199.8 09.8	200.8 09.9 201.8 09.9	202.8 10.0 203.8 10.0	204.8 10.1 205.8 10.1
2	184.1 18.1 185.1 18.2	186.1 18.3 187.1 18.4	188.1 18.5 189.1 18.6	190.1 18.7 191.1 18.8	192.1 18.9 193.1 18.9	194.1 19.0 195.1 19.0	196.1 19.1 197.1 19.1	198.1 19.2 199.1 19.2	200.1 19.3 201.1 19.3	202.1 19.4 203.1 19.4	204.1 19.5 205.1 19.5
3	183.0 27.1 184.0 27.3	185.0 27.4 186.0 27.6	187.0 27.7 188.0 27.9	189.0 28.0 190.0 28.1	191.0 28.2 192.0 28.2	193.0 28.3 194.0 28.3	195.0 28.4 196.0 28.4	197.0 28.5 198.0 28.5	199.0 28.6 200.0 28.6	201.0 28.7 202.0 28.7	203.0 28.8 204.0 28.8
4	181.4 36.1 182.4 36.3	183.4 36.5 184.4 36.7	185.4 36.9 186.4 37.1	187.4 37.3 188.4 37.5	189.4 37.6 190.4 37.6	191.4 37.7 192.4 37.7	193.4 37.8 194.4 37.8	195.4 37.9 196.4 37.9	197.4 38.0 198.4 38.0	199.4 38.1 200.4 38.1	201.4 38.2 202.4 38.2
5	179.5 45.0 180.4 45.2	181.4 45.4 182.4 45.7	183.3 45.9 184.3 46.2	185.3 46.4 186.2 46.7	187.2 46.8 188.1 47.1	189.1 47.3 190.0 47.6	191.0 47.7 192.0 48.0	193.0 48.1 194.0 48.4	195.0 48.5 196.0 48.8	197.0 49.0 198.0 49.3	199.0 49.4 200.0 49.7
6	177.0 53.7 178.0 54.0	179.0 54.3 180.0 54.6	181.0 54.9 182.0 55.1	183.0 55.4 184.0 55.7	185.0 55.8 186.0 56.0	187.0 56.2 188.0 56.4	189.0 56.6 190.0 56.8	191.0 56.9 192.0 57.1	193.0 57.3 194.0 57.5	195.0 57.6 196.0 57.8	197.0 57.9 198.0 58.1
7	174.2 62.3 175.1 62.7	176.1 63.0 177.0 63.3	178.0 63.7 179.0 64.0	180.0 64.3 181.0 64.7	182.0 64.8 183.0 65.1	184.0 65.3 185.0 65.6	186.0 65.7 187.0 65.9	188.0 66.0 189.0 66.2	190.0 66.3 191.0 66.5	192.0 66.6 193.0 66.8	194.0 66.9 195.0 67.1
8	170.9 70.8 171.8 71.2	172.8 71.6 173.7 71.9	174.6 72.3 175.5 72.7	176.5 72.7 177.4 73.0	178.4 73.1 179.3 73.4	180.3 73.4 181.2 73.7	182.2 73.7 183.1 74.0	184.1 74.0 185.0 74.3	186.0 74.3 187.0 74.6	188.0 74.6 189.0 74.9	190.0 74.9 191.0 75.2
9	167.2 79.1 168.1 79.5	169.0 80.0 170.0 80.4	171.0 80.8 172.0 81.2	173.0 81.7 174.0 82.1	175.0 82.1 176.0 82.4	177.0 82.4 178.0 82.7	179.0 82.7 180.0 83.0	181.0 83.0 182.0 83.3	183.0 83.3 184.0 83.6	185.0 83.6 186.0 83.9	187.0 83.9 188.0 84.2
10	163.2 87.2 164.0 87.7	165.0 88.1 166.0 88.6	167.0 89.1 168.0 89.6	169.0 90.0 170.0 90.4	171.0 90.4 172.0 90.7	173.0 90.7 174.0 91.0	175.0 91.0 176.0 91.3	177.0 91.3 178.0 91.6	179.0 91.6 180.0 91.9	181.0 91.9 182.0 92.2	183.0 92.2 184.0 92.5
11	158.7 95.1 159.5 95.6	160.4 96.1 161.2 96.6	162.1 97.2 163.0 97.7	163.8 98.2 164.7 98.7	165.5 98.6 166.4 99.0	167.2 98.9 168.1 99.3	168.9 99.2 169.8 99.6	170.6 99.5 171.5 99.9	172.3 99.8 173.2 100.2	174.0 100.1 175.0 100.5	175.7 100.4 176.7 100.8
12	153.8 102.8 154.6 103.3	155.5 103.9 156.3 104.4	157.1 105.0 158.0 105.6	158.8 106.1 159.6 106.7	160.5 107.2 161.4 107.8	162.2 108.3 163.1 108.9	163.9 109.4 164.8 110.0	165.6 110.5 166.5 111.1	167.3 111.6 168.2 112.2	169.0 112.7 170.0 113.3	170.7 113.8 171.6 114.4
13	148.6 110.2 149.4 110.8	150.2 111.4 151.0 112.0	151.8 112.6 152.6 113.2	153.4 113.8 154.2 114.4	155.0 115.0 155.8 115.6	156.6 116.1 157.4 116.7	158.2 117.2 159.0 117.8	159.8 118.3 160.6 118.9	161.4 119.4 162.2 120.0	163.0 120.5 163.8 121.1	164.6 121.6 165.4 122.2
14	143.0 117.4 143.8 118.0	144.5 118.6 145.3 119.3	146.1 119.9 146.9 120.5	147.6 121.2 148.4 121.8	149.2 122.4 150.0 123.0	150.7 123.6 151.5 124.2	152.3 124.8 153.1 125.4	153.8 125.9 154.6 126.5	155.4 127.0 156.2 127.6	156.9 128.1 157.7 128.7	158.5 129.2 159.3 129.8
15	137.1 124.2 137.8 124.9	138.6 125.6 139.3 126.2	140.0 126.9 140.8 127.6	141.5 128.3 142.3 128.9	143.0 129.4 143.8 130.0	144.5 130.6 145.3 131.2	146.0 131.7 146.8 132.3	147.5 132.8 148.3 133.4	149.0 133.9 149.8 134.5	150.5 135.0 151.3 135.6	152.0 136.1 152.8 136.7
16	130.8 130.8 131.5 131.5	132.2 132.2 132.9 132.9	133.6 133.6 134.3 134.3	135.1 135.1 135.8 135.8	137.0 137.0 137.7 137.7	138.5 138.5 139.2 139.2	140.0 140.0 140.7 140.7	141.5 141.5 142.2 142.2	143.0 143.0 143.7 143.7	144.5 144.5 145.2 145.2	146.0 146.0 146.7 146.7
17	185.0 03.2 186.0 03.2	187.0 03.3 188.0 03.3	189.0 03.3 190.0 03.3	191.0 03.3 192.0 03.4	193.0 03.4 194.0 03.4	195.0 03.4 196.0 03.5	197.0 03.5 198.0 03.5	199.0 03.5 200.0 03.6	201.0 03.6 202.0 03.6	203.0 03.6 204.0 03.7	205.0 03.7 206.0 03.7
18	184.9 06.5 185.9 06.5	186.9 06.5 187.9 06.6	188.9 06.6 189.9 06.6	190.9 06.7 191.9 06.7	192.9 06.7 193.9 06.8	194.9 06.8 195.9 06.8	196.9 06.8 197.9 06.9	198.9 06.9 199.9 06.9	200.9 06.9 201.9 07.0	202.9 07.0 203.9 07.0	204.9 07.0 205.9 07.1
19	184.7 09.7 185.7 09.7	186.7 09.8 187.7 09.8	188.7 09.9 189.7 09.9	190.7 10.0 191.7 10.0	192.7 10.0 193.7 10.1	194.7 10.1 195.7 10.1	196.7 10.1 197.7 10.2	198.7 10.2 199.7 10.2	200.7 10.2 201.7 10.3	202.7 10.3 203.7 10.3	204.7 10.3 205.7 10.4
20	184.5 12.9 185.5 13.0	186.5 13.0 187.5 13.1	188.5 13.2 189.5 13.3	190.5 13.3 191.5 13.4	192.5 13.4 193.5 13.4	194.5 13.4 195.5 13.5	196.5 13.5 197.5 13.5	198.5 13.5 199.5 13.6	200.5 13.6 201.5 13.6	202.5 13.6 203.5 13.7	204.5 13.7 205.5 13.7
21	184.3 16.1 185.3 16.2	186.3 16.3 187.3 16.4	188.3 16.5 189.3 16.6	190.3 16.6 191.3 16.7	192.3 16.7 193.3 16.7	194.3 16.7 195.3 16.8	196.3 16.8 197.3 16.8	198.3 16.8 199.3 16.9	200.3 16.9 201.3 16.9	202.3 16.9 203.3 17.0	204.3 17.0 205.3 17.0
22	184.0 19.3 185.0 19.4	186.0 19.5 187.0 19.7	188.0 19.8 189.0 19.9	190.0 19.9 191.0 20.0	192.0 20.0 193.0 20.0	194.0 20.0 195.0 20.1	196.0 20.1 197.0 20.1	198.0 20.1 199.0 20.2	200.0 20.2 201.0 20.2	202.0 20.2 203.0 20.3	204.0 20.3 205.0 20.3
23	183.6 22.5 184.6 22.7	185.6 22.8 186.6 22.9	187.6 23.0 188.6 23.2	189.6 23.3 190.6 23.4	191.6 23.4 192.6 23.5	193.6 23.5 194.6 23.5	195.6 23.5 196.6 23.6	197.6 23.6 198.6 23.7	199.6 23.7 200.6 23.7	201.6 23.7 202.6 23.8	203.6 23.8 204.6 23.8
24	183.2 25.7 184.2 25.9	185.2 26.0 186.2 26.2	187.2 26.3 188.2 26.4	189.2 26.4 189.1 26.6	191.2 26.6 192.2 26.7	193.2 26.7 194.2 26.8	195.2 26.8 196.2 26.8	197.2 26.8 198.2 26.9	199.2 26.9 200.2 27.0	201.2 27.0 202.2 27.0	203.2 27.0 204.2 27.1
25	182.7 28.9 183.7 29.1	184.7 29.3 185.7 29.4	186.7 29.6 187.7 29.7	188.6 29.9 189.6 30.0	190.6 30.1 191.6 30.1	192.6 30.2 193.6 30.3	194.6 30.3 195.6 30.4	196.6 30.4 197.6 30.4	198.6 30.4 199.6 30.5	200.6 30.5 201.6 30.6	202.6 30.6 203.6 30.6
26	182.2 32.1 183.2 32.3	184.2 32.5 185.2 32.6	186.1 32.8 187.1 33.0	188.1 33.2 189.1 33.2	190.1 33.3 191.1 33.4	192.1 33.4 193.1 33.5	194.1 33.5 195.1 33.6	196.1 33.6 197.1 33.6	198.1 33.6 199.1 33.7	200.1 33.7 201.1 33.8	202.1 33.8 203.1 33.8
27	181.6 35.3 182.6 35.5	183.6 35.7 184.5 35.9	185.5 36.1 186.5 36.3	187.5 36.4 188.5 36.6	189.5 36.6 190.5 36.7	191.5 36.7 192.5 36.8	193.5 36.8 194.5 36.9	195.5 36.9 196.5 36.9	197.5 36.9 198.5 37.0	199.5 37.0 200.5 37.0	201.5 37.0 202.5 37.1
28	181.0 38.5 181.9 38.7	182.9 38.9 183.9 39.1	184.9 39.3 185.8 39.5	186.8 39.7 187.8 39.8	188.8 39.8 189.8 39.9	190.8 39.9 191.8 40.0	192.8 40.0 193.8 40.1	194.8 40.1 195.8 40.1	196.8 40.1 197.8 40.2	198.8 40.2 199.8 40.2	200.8 40.2 201.8 40.3
29	180.3 41.6 181.2 41.8	182.2 42.1 183.2 42.3	184.2 42.5 185.1 42.7	186.1 42.7 187.1 42.8	188.1 42.8 189.1 42.9	190.1 42.9 191.1 43.0	192.1 43.0 193.1 43.1	194.1 43.1 195.1 43.1	196.1 43.1 197.1 43.2	198.1 43.2 199.1 43.2	200.1 43.2 201.1 43.3
30	179.5 44.8 180.5 45.0	181.4 45.2 182.4 45.5	183.4 45.7 184.4 45.9	185.3 46.0 186.3 46.2	187.3 46.2 188.3 46.3	189.3 46.3 190.3 46.4	191.3 46.4 192.3 46.5	193.3 46.5 194.3 46.5	195.3 46.5 196.3 46.6	197.3 46.6 198.3 46.6	199.3 46.6 200.3 46.7
31	178.7 47.9 179.7 48.1	180.6 48.4 181.6 48.7	182.6 48.9 183.5 49.2	184.5 49.4 185.5 49.6	186.5 49.6 187.5 49.7	188.5 49.7 189.5 49.8	190.5 49.8 191.5 49.9	192.5 49.9 193.5 49.9	194.5 49.9 195.5 50.0	196.5 50.0 197.5 50.0	198.5 50.0 199.5 50.1
32	177.8 51.0 178.8 51.3	179.8 51.5 180.7 51.8	181.7 52.1 182.6 52.4	183.6 52.4 184.6 52.6	185.6 52.6 186.6 52.7	187.6 52.7 188.6 52.8	189.6 52.8 190.6 52.9	191.6 52.9 192.6 52.9	193.6 52.9 194.6 53.0	195.6 53.0 196.6 53.0	197.6 53.0 198.6 53.1
33	176.9 54.1 177.9 54.4	178.8 54.7 179.8 55.0	180.7 55.3 181.7 55.6	182.7 55.6 183.7 55.8	184.7 55.8 185.7 55.9	186.7 55.9 187.7 56.0	188.7 56.0 189.7 56.1	190.7 56.1 191.7 56.1	192.7 56.1 193.7 56.2	194.7 56.2 195.7 56.2	196.7 56.2 197.7 56.3
34	175.9 57.2 176.9 57.5	177.8 57.8 178.8 58.1	179.7 58.4 180.7 58.7	181.7 58.7 182.7 58.9	183.7 58.9 184.7 59.0	185.7 59.0 186.7 59.1	187.7 59.1 188.7 59.2	189.7 59.2 190.7 59.2	191.7 59.2 192.7 59.3	193.7 59.3 194.7 59.3	195.7 59.3 196.7 59.4
35	174.9 60.2 175.9 60.6	176.8 60.9 177.8 61.2	178.7 61.5 179.7 61.8	180.6 61.8 181.6 61.9	182.6 61.9 183.6 62.0	184.6 62.0 185.6 62.1	186.6 62.1 187.6 62.2	188.6 62.2 189.6 62.2	190.6 62.2 191.6 62.3	192.6 62.3 193.6 62.3	194.6 62.3 195.6 62.4
36	173.8 63.3 174.8 63.6	175.7 64.0 176.7 64.3	177.6 64.6 178.6 64.9	179.5 64.9 180.5 65.0	181.5 65.0 182.5 65.1	183.5 65.1 184.5 65.2	185.5 65.2 186.5 65.2	187.5 65.2 188.5 65.3	189.5 65.3 190.5 65.3	191.5 65.3 192.5 65.4	193.5 65.4 194.5 65.4
37	172.7 66.3 173.6 66.7	174.6 67.0 175.5 67.4	176.4 67.7 177.4 68.1	178.3 68.1 179.3 68.2	180.3 68.2 181.3 68.3	182.3 68.3 183.3 68.4	184.3 68.4 185.3 68.4	186.3 68.4 187.3 68.5	188.3 68.5 189.3 68.5	190.3 68.5 191.3 68.6	192.3 68.6 193.3 68.6
38	171.5 69.3 172.5 69.7	173.4 70.1 174.3 70.4	175.2 70.8 176.2 71.2	177.1 71.2 178.1 71.3	179.0 71.3 180.0 71.4	181.0 71.4 182.0 71.5	183.0 71.5 184.0 71.5	185.0 71.5 186.0 71.6	187.0 71.6 188.0 71.6	189.0 71.6 190.0 71.7	191.0 71.7 192.0 71.7
39	170.3 72.3 171.2 72.7	172.1 73.1 173.1 73.5	174.0 73.8 175.0 74.2	176.0 74.2 177.0 74.3	178.0 74.3 179.0 74.4	180.0 74.4 181.0 74.5	182.0 74.5 183.0 74.5	184.0 74.5 185.0 74.6	186.0 74.6 187.0 74.6	188.0 74.6 189.0 74.7	190.0 74.7 191.0 74.7
40	169.0 75.2 169.9 75.7	170.8 76.1 171.7 76.5	172.7 76.9 173.6 77.3	174.5 77.3 175.5 77.7	176.4 77.7 177.4 77.9	178.3 77.9 179.3 78.0	180.3 78.0 181.3 78.1	182.3 78.1 183.3 78.1	184.3 78.1 185.3 78.2	186.3 78.2 187.3 78.2	188.3 78.2 189.3

(x.)

Traverse Table.

Distance. 193			194		195		196		197		198		199		200		Error
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	
1	192.8	09.5	193.8	09.5	194.8	09.6	195.8	09.6	196.8	09.7	197.8	09.7	198.8	09.8	199.8	09.8	7
	192.1	18.9	193.1	19.0	194.1	19.1	195.1	19.2	196.1	19.3	197.0	19.4	198.0	19.5	199.0	19.6	
	190.9	28.3	191.9	28.5	192.9	28.6	193.9	28.8	194.9	28.9	195.9	29.0	196.8	29.2	197.8	29.3	
	189.3	37.7	190.3	37.8	191.2	38.0	192.2	38.2	193.2	38.4	194.2	38.6	195.2	38.8	196.2	39.0	
	187.2	46.9	188.2	47.1	189.2	47.4	190.1	47.6	191.1	47.9	192.1	48.1	193.0	48.4	194.0	48.6	
2	184.7	56.0	185.7	56.3	186.6	56.6	187.6	56.9	188.5	57.2	189.5	57.5	190.4	57.8	191.4	58.1	6
	181.7	65.0	182.7	65.4	183.6	65.7	184.5	66.0	185.5	66.4	186.4	66.7	187.4	67.0	188.3	67.4	
	178.3	73.9	179.2	74.2	180.2	74.6	181.1	75.0	182.0	75.4	182.9	75.8	183.9	76.2	184.8	76.5	
	174.5	82.5	175.4	83.0	176.3	83.4	177.2	83.8	178.1	84.2	179.0	84.7	179.9	85.1	180.8	85.5	
	170.2	91.0	171.1	91.4	172.0	91.9	172.9	92.4	173.7	92.9	174.6	93.3	175.5	93.8	176.4	94.3	
3	165.5	99.2	166.4	99.7	167.3	100.2	168.1	100.8	169.0	101.3	169.8	101.8	170.7	102.3	171.5	102.8	5
	160.5	107.2	161.3	107.8	162.1	108.3	163.0	108.9	163.8	109.4	164.6	110.0	165.5	110.6	166.3	111.1	
	155.0	115.0	155.8	115.6	156.6	116.2	157.4	116.8	158.2	117.4	159.0	118.0	159.8	118.5	160.6	119.1	
	149.2	122.4	150.0	123.1	150.7	123.7	151.5	124.3	152.3	125.0	153.1	125.6	153.8	126.2	154.6	126.9	
	143.0	129.6	143.7	130.3	144.5	130.9	145.2	131.6	146.0	132.3	146.7	133.0	147.4	133.6	148.2	134.3	
4	136.5	136.5	137.2	137.2	137.9	137.9	138.6	138.6	139.3	139.3	140.0	140.0	140.7	140.7	141.4	141.4	4
	193.0	03.4	194.0	03.4	195.0	03.4	196.0	03.4	197.0	03.4	198.0	03.5	199.0	03.5	200.0	03.5	
	192.9	06.7	193.2	06.8	194.9	06.8	195.9	06.8	196.9	06.9	197.9	06.9	198.9	06.9	199.9	07.0	
	192.7	10.1	193.7	10.2	194.7	10.2	195.7	10.3	196.7	10.3	197.7	10.4	198.7	10.4	199.7	10.5	
	192.5	13.5	193.5	13.5	194.5	13.6	195.5	13.7	196.5	13.7	197.5	13.8	198.5	13.9	199.5	14.0	
5	192.3	16.8	193.3	16.9	194.3	17.0	195.3	17.1	196.3	17.2	197.2	17.3	198.2	17.3	199.2	17.4	85
	191.9	20.2	192.9	20.3	193.9	20.4	194.9	20.5	195.9	20.6	196.9	20.7	197.9	20.8	198.9	20.9	
	191.6	23.5	192.6	23.6	193.5	23.8	194.5	23.9	195.5	24.0	196.5	24.1	197.5	24.3	198.5	24.4	
	191.1	26.9	192.1	27.0	193.1	27.1	194.1	27.3	195.1	27.4	196.1	27.6	197.1	27.7	198.1	27.8	
	190.6	30.2	191.6	30.3	192.6	30.5	193.6	30.7	194.6	30.8	195.6	31.0	196.5	31.1	197.5	31.3	
10	190.1	33.5	191.1	33.7	192.0	33.9	193.0	34.0	194.0	34.2	195.0	34.4	196.0	34.6	197.0	34.7	80
	189.5	36.8	190.4	37.0	191.4	37.2	192.4	37.4	193.4	37.6	194.4	37.8	195.3	38.0	196.3	38.2	
	188.8	40.1	189.8	40.3	190.7	40.5	191.7	40.8	192.7	41.0	193.7	41.2	194.7	41.4	195.6	41.6	
	188.1	43.4	189.0	43.6	190.0	43.9	191.0	44.1	192.0	44.3	192.9	44.5	193.9	44.8	194.9	45.0	
	187.3	46.7	188.2	46.9	189.2	47.2	190.2	47.4	191.1	47.7	192.1	47.9	193.1	48.1	194.1	48.4	
15	186.4	50.0	187.4	50.2	188.4	50.5	189.3	50.7	190.3	51.0	191.3	51.2	192.2	51.5	193.2	51.8	76
	185.5	53.2	186.5	53.5	187.4	53.7	188.4	54.0	189.4	54.3	190.3	54.6	191.3	54.9	192.3	55.1	
	184.6	56.4	185.5	56.7	186.5	57.0	187.4	57.3	188.4	57.6	189.3	57.9	190.3	58.2	191.3	58.5	
	183.6	59.6	184.5	59.9	185.5	60.3	186.4	60.6	187.4	60.9	188.3	61.2	189.3	61.5	190.2	61.8	
	182.5	62.8	183.4	63.2	184.3	63.5	185.3	63.8	186.3	64.1	187.2	64.5	188.2	64.8	189.1	65.1	
20	181.4	66.0	182.3	66.4	183.2	66.7	184.2	67.0	185.1	67.4	186.1	67.7	187.0	68.1	187.9	68.4	70
	180.2	69.2	181.1	69.5	182.0	69.9	183.0	70.2	183.9	70.6	184.8	71.0	185.8	71.3	186.7	71.7	
	178.9	72.3	179.9	72.7	180.8	73.0	181.7	73.4	182.7	73.8	183.6	74.1	184.5	74.5	185.4	74.9	
	177.7	75.4	178.6	75.8	179.5	76.2	180.4	76.6	181.3	77.0	182.3	77.4	183.2	77.8	184.1	78.1	
	176.3	78.5	177.2	78.9	178.1	79.3	179.1	79.7	180.0	80.1	180.9	80.5	181.8	80.9	182.7	81.3	
25	174.9	81.6	175.8	82.0	176.7	82.4	177.6	82.8	178.5	83.3	179.4	83.7	180.4	84.1	181.3	84.5	65
	173.5	84.6	174.4	85.0	175.3	85.5	176.2	85.9	177.1	86.4	178.0	86.8	178.9	87.2	179.8	87.7	
	172.0	87.6	172.9	88.1	173.7	88.5	174.6	89.0	175.5	89.4	176.4	89.9	177.3	90.3	178.2	90.8	
	170.4	90.6	171.3	91.1	172.2	91.5	173.1	92.0	173.9	92.5	174.8	93.0	175.7	93.4	176.6	93.9	
	168.8	93.6	169.7	94.1	170.6	94.5	171.4	95.0	172.3	95.5	173.2	96.0	174.0	96.5	174.9	97.0	
30	167.1	96.5	168.0	97.0	168.9	97.5	169.7	98.0	170.6	98.5	171.5	99.0	172.3	99.5	173.2	100.0	60
	165.4	99.4	166.3	99.9	167.1	100.4	168.0	100.9	168.9	101.5	169.7	102.0	170.6	102.5	171.4	103.0	
	163.7	102.3	164.5	102.8	165.4	103.3	166.2	103.9	167.1	104.4	167.9	104.9	168.8	105.5	169.6	106.0	
	161.9	105.1	162.7	105.7	163.5	106.2	164.4	106.7	165.2	107.3	166.1	107.8	166.9	108.4	167.7	108.9	
	160.0	107.9	160.8	108.5	161.7	109.0	162.5	109.6	163.3	110.2	164.1	110.7	165.0	111.3	165.8	111.8	
35	158.1	110.7	158.9	111.3	159.7	111.8	160.6	112.4	161.4	113.0	162.2	113.6	163.0	114.1	163.8	114.7	55
	156.1	113.4	156.9	114.0	157.8	114.6	158.6	115.2	159.4	115.8	160.2	116.4	161.0	117.0	161.8	117.6	
	154.1	116.2	154.9	116.8	155.7	117.4	156.5	118.0	157.3	118.6	158.1	119.2	158.9	119.8	159.7	120.4	
	152.1	118.8	152.9	119.4	153.7	120.1	154.5	120.7	155.2	121.3	156.0	121.9	156.8	122.5	157.6	123.1	
	150.0	121.5	150.8	122.1	151.5	122.7	152.3	123.3	153.1	124.0	153.9	124.6	154.7	125.2	155.4	125.9	
40	147.8	124.1	148.6	124.7	149.4	125.3	150.1	126.0	150.9	126.6	151.7	127.3	152.4	127.9	153.2	128.6	50
	145.7	126.6	146.4	127.3	147.2	127.9	147.9	128.6	148.7	129.2	149.4	129.9	150.2	130.6	150.9	131.2	
	143.4	129.1	144.2	129.8	145.0	130.5	145.7	131.1	146.4	131.8	147.1	132.5	147.9	133.2	148.6	133.8	
	141.2	131.6	141.9	132.3	142.6	133.0	143.3	133.7	144.1	134.4	144.8	135.0	145.5	135.7	146.3	136.4	
	138.8	134.1	139.6	134.8	140.3	135.5	141.0	136.2	141.7	136.8	142.4	137.5	143.1	138.2	143.9	138.9	
45	136.5	136.5	137.2	137.2	137.9	137.9	138.6	138.6	139.3	139.3	140.0	140.0	140.7	140.7	141.4	141.4	45
	193.0	03.4	194.0	03.4	195.0	03.4	196.0	03.4	197.0	03.4	198.0	03.5	199.0	03.5	200.0	03.5	
	192.9	06.7	193.2	06.8	194.9	06.8	195.9	06.8	196.9	06.9	197.9	06.9	198.9	06.9	199.9	07.0	
	192.7	10.1	193.7	10.2	194.7	10.2	195.7	10.3	196.7	10.3	197.7	10.4	198.7	10.4	199.7	10.5	
	192.5	13.5	193.5	13.5	194.5	13.6	195.5	13.7	196.5	13.7	197.5	13.8	198.5	13.9	199.5	14.0	

Traverse Table.

(x.)

Distance. 201			202		203		204		205		206		207		208			
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.	
1	200.8	09.9	201.8	09.9	202.8	10.0	203.8	10.0	204.8	10.1	205.8	10.1	206.8	10.2	207.8	10.2	7	
	200.0	19.7	201.0	19.8	202.0	19.9	203.0	20.0	204.0	20.1	205.0	20.2	206.0	20.3	207.0	20.4	4	
	198.8	29.5	199.8	29.6	200.8	29.8	201.8	29.9	202.8	30.1	203.8	30.2	204.8	30.4	205.7	30.5	4	
	197.1	39.2	198.1	39.4	199.1	39.6	200.1	39.8	201.1	40.0	202.0	40.2	203.0	40.4	204.0	40.6	7	
	195.0	48.8	195.9	49.1	196.9	49.3	197.9	49.6	198.9	49.8	199.8	50.1	200.8	50.3	201.8	50.5	3	
2	192.2	58.4	193.3	58.6	194.3	58.9	195.2	59.2	196.2	59.5	197.1	59.8	198.1	60.1	199.0	60.4	3	
	189.2	67.7	190.2	68.0	191.1	68.4	192.1	68.7	193.0	69.1	194.0	69.4	194.9	69.7	195.8	70.1	3	
	185.7	76.9	186.6	77.3	187.6	77.7	188.5	78.1	189.4	78.5	190.3	78.8	191.2	79.2	192.2	79.6	6	
	181.7	85.9	182.6	86.4	183.5	86.8	184.4	87.2	185.3	87.7	186.2	88.1	187.1	88.5	188.0	88.9	3	
	177.3	94.7	178.2	95.2	179.0	95.7	179.9	96.2	180.8	96.6	181.7	97.1	182.6	97.6	183.4	98.0	3	
3	172.4	103.3	173.3	103.8	174.1	104.4	175.0	104.9	175.8	105.4	176.7	105.9	177.5	106.4	178.4	106.9	3	
	167.1	111.7	168.0	112.2	168.8	112.8	169.6	113.3	170.4	113.9	171.3	114.4	172.1	115.0	172.9	115.6	5	
	161.4	119.7	162.2	120.3	163.0	120.9	163.9	121.5	164.7	122.1	165.5	122.7	166.3	123.3	167.1	123.9	3	
	155.4	127.5	156.1	128.1	156.9	128.8	157.7	129.4	158.5	130.0	159.2	130.7	160.0	131.3	160.8	132.0	4	
	148.9	135.0	149.7	135.6	150.4	136.3	151.1	137.0	151.9	137.7	152.6	138.3	153.4	139.0	154.1	139.7	4	
4	142.1	142.1	142.8	142.8	143.5	143.5	144.2	144.2	145.0	145.0	145.7	145.7	146.4	146.4	147.1	147.1	4	
	10	201.0	03.5	202.0	03.5	203.0	03.5	204.0	03.6	205.0	03.6	206.0	03.6	207.0	03.6	208.0	03.6	890
	2	200.9	07.0	201.9	07.0	202.9	07.1	203.9	07.1	204.9	07.2	205.9	07.2	206.9	07.2	207.9	07.3	88
	3	200.7	10.5	201.7	10.6	202.7	10.6	203.7	10.7	204.7	10.7	205.7	10.8	206.7	10.8	207.7	10.9	87
4	200.5	14.0	201.5	14.1	202.5	14.2	203.5	14.2	204.5	14.3	205.5	14.4	206.5	14.4	207.5	14.5	86	
5	200.2	17.5	201.2	17.6	202.2	17.7	203.2	17.8	204.2	17.9	205.2	18.0	206.2	18.0	207.2	18.1	85	
6	199.9	21.0	200.9	21.1	201.9	21.2	202.9	21.3	203.9	21.4	204.9	21.5	205.9	21.6	206.9	21.7	84	
7	199.5	24.5	200.5	24.6	201.5	24.7	202.5	24.9	203.5	25.0	204.5	25.1	205.5	25.2	206.4	25.3	83	
8	199.0	28.0	200.0	28.1	201.0	28.3	202.0	28.4	203.0	28.5	204.0	28.7	205.0	28.8	206.0	28.9	82	
9	198.5	31.4	199.5	31.6	200.5	31.8	201.5	31.9	202.5	32.1	203.5	32.2	204.5	32.4	205.4	32.5	81	
10	197.9	34.9	198.9	35.1	199.9	35.3	200.9	35.4	201.9	35.6	202.9	35.8	203.9	35.9	204.8	36.1	80	
11	197.3	38.4	198.3	38.5	199.3	38.7	200.3	38.9	201.2	39.1	202.2	39.3	203.2	39.5	204.2	39.7	79	
12	196.6	41.8	197.6	42.0	198.6	42.2	199.5	42.4	200.5	42.6	201.5	42.8	202.5	43.0	203.5	43.2	78	
13	195.8	45.2	196.8	45.4	197.8	45.7	198.8	45.9	199.7	46.1	200.7	46.3	201.7	46.6	202.7	46.8	77	
14	195.0	48.6	196.0	48.9	197.0	49.1	197.9	49.4	198.9	49.6	199.9	49.8	200.9	50.1	201.8	50.3	76	
15	194.2	52.0	195.1	52.3	196.1	52.5	197.0	52.8	198.0	53.1	199.0	53.3	199.9	53.6	200.9	53.8	75	
16	193.2	55.4	194.2	55.7	195.1	56.0	196.1	56.2	197.1	56.5	198.0	56.8	199.0	57.1	199.9	57.3	74	
17	192.2	58.8	193.2	59.1	194.1	59.4	195.1	59.6	196.0	59.9	197.0	60.2	198.0	60.5	198.9	60.8	73	
18	191.2	62.1	192.1	62.4	193.1	62.7	194.0	63.0	195.0	63.3	195.9	63.7	196.9	64.0	197.8	64.3	72	
19	190.0	65.4	191.0	65.8	191.9	66.1	192.9	66.4	193.8	66.7	194.8	67.1	195.7	67.4	196.7	67.7	71	
20	188.9	68.7	189.8	69.1	190.8	69.4	191.7	69.8	192.6	70.1	193.6	70.5	194.5	70.8	195.5	71.1	70	
21	187.6	72.0	188.6	72.4	189.5	72.7	190.5	73.1	191.4	73.5	192.3	73.8	193.3	74.2	194.2	74.5	69	
22	186.4	75.3	187.3	75.7	188.2	76.0	189.1	76.4	190.1	76.8	191.0	77.2	191.9	77.5	192.9	77.9	68	
23	185.0	78.5	185.9	78.9	186.9	79.3	187.8	79.7	188.7	80.1	189.6	80.5	190.5	80.9	191.5	81.3	67	
24	183.6	81.8	184.5	82.2	185.4	82.6	186.4	83.0	187.3	83.4	188.2	83.8	189.1	84.2	190.0	84.6	66	
25	182.2	84.9	183.1	85.4	184.0	85.8	184.9	86.2	185.8	86.6	186.7	87.1	187.6	87.5	188.5	87.9	65	
26	180.7	88.1	181.6	88.6	182.5	89.0	183.4	89.4	184.3	89.9	185.2	90.3	186.1	90.7	186.9	91.2	64	
27	179.1	91.3	180.0	91.7	180.9	92.2	181.8	92.6	182.7	93.1	183.5	93.5	184.4	94.0	185.3	94.4	63	
28	177.5	94.4	178.4	94.8	179.2	95.3	180.1	95.8	181.0	96.2	181.9	96.7	182.8	97.2	183.7	97.7	62	
29	175.8	97.4	176.7	97.9	177.5	98.4	178.4	98.9	179.3	99.4	180.2	99.9	181.0	100.4	181.9	100.8	61	
30	174.1	100.5	174.9	101.0	175.8	101.5	176.7	102.0	177.5	102.5	178.4	103.0	179.3	103.5	180.1	104.0	60	
31	172.3	103.5	173.1	104.0	174.0	104.6	174.9	105.1	175.7	105.6	176.5	106.1	177.4	106.6	178.3	107.1	59	
32	170.5	106.5	171.3	107.0	172.2	107.6	173.0	108.1	173.8	108.6	174.7	109.2	175.5	109.7	176.4	110.2	58	
33	168.6	109.5	169.4	110.0	170.3	110.6	171.1	111.1	171.9	111.7	172.8	112.2	173.6	112.7	174.4	113.3	57	
34	166.6	112.4	167.5	113.0	168.3	113.5	169.1	114.1	170.0	114.6	170.8	115.2	171.6	115.8	172.4	116.3	56	
35	164.6	115.3	165.5	115.9	166.3	116.4	167.1	117.0	167.9	117.6	168.7	118.2	169.6	118.7	170.4	119.3	55	
36	162.6	118.1	163.4	118.7	164.2	119.3	165.0	119.9	165.8	120.5	166.7	121.1	167.5	121.7	168.3	122.3	54	
37	160.5	121.0	161.3	121.6	162.1	122.2	162.9	122.8	163.7	123.4	164.5	124.0	165.3	124.6	166.1	125.2	53	
38	158.4	123.7	159.2	124.4	160.0	125.0	160.8	125.6	161.5	126.2	162.3	126.8	163.1	127.4	163.9	128.1	52	
39	156.2	126.5	157.0	127.1	157.8	127.8	158.5	128.4	159.3	129.0	160.1	129.6	160.9	130.3	161.6	130.9	51	
40	154.0	129.2	154.7	129.8	155.5	130.5	156.3	131.1	157.0	131.8	157.8	132.4	158.6	133.1	159.3	133.7	50	
41	151.7	131.9	152.5	132.5	153.2	133.2	154.0	133.8	154.7	134.5	155.5	135.1	156.2	135.8	157.0	136.5	49	
42	149.4	134.5	150.1	135.2	150.9	135.8	151.6	136.5	152.3	137.2	153.1	137.8	153.8	138.5	154.6	139.2	48	
43	147.0	137.1	147.7	137.8	148.5	138.4	149.2	139.1	149.9	139.8	150.7	140.5	151.4	141.2	152.1	141.9	47	
44	144.6	139.6	145.3	140.3	146.0	141.0	146.7	141.7	147.5	142.4	148.2	143.1	148.9	143.8	149.6	144.5	46	
45	142.1	142.1	142.8	142.8	143.5	143.5	144.2	144.2	145.0	145.0	145.7	145.7	146.4	146.4	147.1	147.1	45	
Crs.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Crs.	

Traverse Table.

(x.)

Distance. 209			210			211			212			213			214			215			216			
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse.	
1 1 2 3 4	208.8	10.3	209.8	10.3	210.7	10.4	211.7	10.4	212.7	10.5	213.7	10.5	214.7	10.6	215.7	10.6							7 6 5 4 3 2 1	
	208.0	20.5	209.0	20.6	210.0	20.7	211.0	20.8	212.0	20.9	213.0	21.0	214.0	21.1	215.0	21.2								
	206.7	30.7	207.7	30.8	208.7	30.9	209.7	31.1	210.7	31.2	211.7	31.4	212.7	31.5	213.7	31.7								
	205.0	40.8	206.9	41.0	206.9	41.2	207.9	41.4	208.9	41.6	209.9	41.7	210.9	41.9	211.8	42.1								
2 1 2 3 4	202.7	50.8	203.7	51.0	204.7	51.3	205.6	51.5	206.6	51.8	207.6	52.0	208.6	52.2	209.5	52.5							3 2 1 0 9 8 7 6 5 4 3 2 1	
	200.0	60.7	201.0	61.0	201.9	61.2	202.9	61.5	203.8	61.8	204.8	62.1	205.7	62.4	206.7	62.7								
	196.8	70.4	197.7	70.7	198.7	71.1	199.6	71.4	200.5	71.8	201.5	72.1	202.4	72.4	203.4	72.8								
	193.1	80.0	194.0	80.4	194.9	80.8	195.9	81.1	196.8	81.5	197.7	81.9	198.6	82.3	199.6	82.7								
3 1 2 3 4	188.9	89.4	189.8	89.8	190.7	90.2	191.6	90.6	192.6	91.1	193.5	91.5	194.4	91.9	195.3	92.4							3 2 1 0 9 8 7 6 5 4 3 2 1	
	184.3	98.5	185.2	99.0	186.1	99.5	187.0	99.9	187.8	100.4	188.7	100.9	189.6	101.3	190.5	101.8								
	179.2	107.4	180.1	108.0	181.0	108.5	181.8	109.0	182.7	109.5	183.5	110.0	184.4	110.5	185.3	111.0								
	173.8	116.1	174.6	116.7	175.4	117.2	176.3	117.8	177.1	118.3	177.9	118.9	178.8	119.4	179.6	120.0								
4 1 2 3 4	167.9	124.5	168.7	125.1	169.5	125.7	170.3	126.3	171.1	126.9	171.9	127.5	172.7	128.1	173.5	128.7							3 2 1 0 9 8 7 6 5 4 3 2 1	
	161.6	132.6	162.3	133.2	163.1	133.9	163.9	134.5	164.6	135.1	165.4	135.8	166.2	136.4	167.0	137.0								
	154.9	140.3	155.6	141.0	156.3	141.7	157.1	142.4	157.8	143.0	158.6	143.7	159.3	144.4	160.0	145.0								
	147.8	147.8	148.5	148.5	149.2	149.2	149.9	149.9	150.6	150.6	151.3	151.3	152.0	152.0	152.7	152.7								
19	209.0	03.6	210.0	03.7	211.0	03.7	212.0	03.7	213.0	03.7	214.0	03.7	215.0	03.8	216.0	03.8							899	
2	208.9	07.3	209.9	07.3	210.9	07.4	211.9	07.4	212.9	07.4	213.9	07.5	214.9	07.5	215.9	07.5							88	
3	208.7	10.9	209.7	11.0	210.7	11.0	211.7	11.1	212.7	11.1	213.7	11.2	214.7	11.3	215.7	11.3							87	
4	208.5	14.6	209.5	14.6	210.5	14.7	211.5	14.8	212.5	14.9	213.5	14.9	214.5	15.0	215.5	15.1							86	
5	208.2	18.2	209.2	18.3	210.2	18.4	211.2	18.5	212.2	18.6	213.2	18.7	214.2	18.7	215.2	18.8							85	
6	207.9	21.8	208.8	22.0	209.8	22.1	210.8	22.2	211.8	22.3	212.8	22.4	213.8	22.5	214.8	22.6							84	
7	207.4	25.5	208.4	25.6	209.4	25.7	210.4	25.8	211.4	26.0	212.4	26.1	213.4	26.2	214.4	26.3							83	
8	207.0	29.1	208.0	29.2	208.9	29.4	209.9	29.5	210.9	29.6	211.9	29.8	212.9	29.9	213.9	30.1							82	
9	206.4	32.7	207.4	32.9	208.4	33.0	209.4	33.2	210.4	33.3	211.4	33.5	212.4	33.6	213.3	33.8							81	
10	205.8	36.3	206.8	36.5	207.8	36.6	208.8	36.8	209.8	37.0	210.7	37.2	211.7	37.3	212.7	37.5							80	
11	205.2	39.9	206.1	40.1	207.1	40.3	208.1	40.5	209.1	40.6	210.1	40.8	211.0	41.0	212.0	41.2							79	
12	204.4	43.5	205.4	43.7	206.4	43.9	207.4	44.1	208.3	44.3	209.3	44.5	210.3	44.7	211.3	44.9							78	
13	203.6	47.0	204.6	47.2	205.6	47.5	206.6	47.7	207.5	47.9	208.5	48.1	209.5	48.4	210.5	48.6							77	
14	202.8	50.6	203.8	50.8	204.7	51.0	205.7	51.3	206.7	51.5	207.6	51.8	208.6	52.0	209.6	52.3							76	
15	201.9	54.1	202.8	54.4	203.8	54.6	204.8	54.9	205.7	55.1	206.7	55.4	207.7	55.6	208.6	55.9							75	
16	200.9	57.6	201.9	57.9	202.8	58.2	203.8	58.4	204.7	58.7	205.7	59.0	206.7	59.3	207.6	59.5							74	
17	199.9	61.1	200.8	61.4	201.8	61.7	202.7	62.0	203.7	62.3	204.6	62.6	205.6	62.9	206.6	63.2							73	
18	198.8	64.6	199.7	64.9	200.7	65.2	201.6	65.5	202.6	65.8	203.5	66.1	204.5	66.4	205.4	66.7							72	
19	197.6	68.0	198.6	68.4	199.5	68.7	200.4	69.0	201.4	69.3	202.3	69.7	203.3	70.0	204.2	70.3							71	
20	196.4	71.5	197.3	71.8	198.3	72.2	199.2	72.5	200.2	72.9	201.1	73.2	202.0	73.5	203.0	73.9							70	
21	195.1	74.9	196.1	75.3	197.0	75.6	197.9	76.0	198.9	76.3	199.8	76.7	200.7	77.0	201.7	77.4							69	
22	193.8	78.3	194.7	78.7	195.6	79.0	196.6	79.4	197.5	79.8	198.4	80.2	199.3	80.5	200.3	80.9							68	
23	192.4	81.7	193.3	82.1	194.2	82.4	195.1	82.8	196.1	83.2	197.0	83.6	197.9	84.0	198.8	84.4							67	
24	190.9	85.0	191.8	85.4	192.8	85.8	193.7	86.2	194.6	86.6	195.5	87.0	196.4	87.4	197.3	87.9							66	
25	189.4	88.3	190.3	88.7	191.2	89.2	192.1	89.6	193.0	90.0	193.9	90.4	194.9	90.9	195.8	91.3							65	
26	187.8	91.6	188.7	92.1	189.6	92.5	190.5	92.9	191.4	93.4	192.3	93.8	193.2	94.2	194.1	94.7							64	
27	186.2	94.9	187.1	95.3	188.0	95.8	188.9	96.2	189.8	96.7	190.7	97.2	191.6	97.6	192.5	98.1							63	
28	184.5	98.1	185.4	98.6	186.3	99.1	187.2	99.5	188.1	100.0	189.0	100.5	189.8	100.9	190.7	101.4							62	
29	182.8	101.3	183.7	101.8	184.5	102.3	185.4	102.8	186.3	103.3	187.2	103.7	188.0	104.2	188.9	104.7							61	
30	181.0	104.5	181.9	105.0	182.7	105.5	183.6	106.0	184.5	106.5	185.3	107.0	186.2	107.5	187.1	108.0							60	
31	179.1	107.6	180.0	108.2	180.9	108.7	181.7	109.2	182.6	109.7	183.4	110.2	184.3	110.7	185.1	111.2							59	
32	177.2	110.8	178.1	111.3	178.9	111.8	179.8	112.3	180.6	112.9	181.5	113.4	182.3	113.9	183.2	114.5							58	
33	175.3	113.8	176.1	114.4	177.0	114.9	177.8	115.5	178.6	116.0	179.5	116.6	180.3	117.1	181.2	117.6							57	
34	173.3	116.9	174.1	117.4	174.9	118.0	175.8	118.5	176.6	119.1	177.4	119.7	178.2	120.2	179.1	120.8							56	
35	171.2	119.9	172.0	120.5	172.8	121.0	173.7	121.6	174.5	122.2	175.3	122.7	176.1	123.3	176.9	123.9							55	
36	169.1	122.8	169.9	123.4	170.7	124.0	171.5	124.6	172.3	125.2	173.1	125.8	173.9	126.4	174.7	127.0							54	
37	166.9	125.8	167.7	126.4	168.5	127.0	169.3	127.6	170.1	128.2	170.9	128.8	171.7	129.4	172.5	130.0							53	
38	164.7	128.7	165.5	129.3	166.3	129.9	167.1	130.5	167.8	131.1	168.6	131.8	169.4	132.4	170.2	133.0							52	
39	162.4	131.5	163.2	132.2	164.0	132.8	164.8	133.4	165.5	134.0	166.3	134.7	167.1	135.3	167.9	135.9							51	
40	160.1	134.3	160.9	135.0	161.6	135.6	162.4	136.3	163.2	136.9	163.9	137.6	164.7	138.2	165.5	138.8							50	
41	157.7	137.1	158.5	137.8	159.2	138.4	160.0	139.1	160.8	139.7	161.5	140.4	162.3	141.1	163.0	141.7							49	
42	155.3	139.8	156.1	140.5	156.8	141.2	157.5	141.9	158.3	142.5	159.0	143.2	159.8	143.9	160.5	144.5							48	
43	152.9	142.5	153.6	143.2	154.3	143.9	155.0	144.6	155.8	145.3	156.5	145.9	157.2	146.6	158.0	147.3							47	
44	150.3	145.2	151.1	145.9	151.8	146.6	152.5	147.3	153.2	148.0	153.9	148.7	154.7	149.4	155.4	150.0							46	
45	147.8	147.8	148.5	148.5	149.2	149.2	149.9	149.9	150.6	150.6	151.3	151.3	152.0	152.0	152.7	152.7							45	
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.																	

Traverse Table.

(x.)

Distance. 217			218			219			220			221			222			223			224		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.		
1 14 3 4 5 6	216.7	10.7	217.7	10.7	218.7	10.8	219.7	10.8	220.7	10.8	221.7	10.9	222.7	10.9	223.7	11.0	224.7	11.0	225.7	11.0	226.7	11.0	
	216.0	21.3	216.9	21.4	217.9	21.5	218.9	21.6	219.9	21.7	220.9	21.8	221.9	21.9	222.9	22.0	223.9	22.1	224.9	22.2	225.9	22.3	
	214.6	31.8	215.6	32.0	216.6	32.1	217.6	32.3	218.6	32.4	219.6	32.6	220.6	32.7	221.6	32.9	222.6	33.0	223.6	33.1	224.6	33.2	
	212.8	42.3	213.8	42.5	214.8	42.7	215.8	42.9	216.7	43.1	217.7	43.3	218.7	43.5	219.7	43.7	220.7	43.9	221.7	44.1	222.7	44.3	
	210.5	52.7	211.5	53.0	212.4	53.2	213.4	53.5	214.4	53.7	215.4	53.9	216.3	54.2	217.3	54.4	218.3	54.7	219.3	55.0	220.3	55.3	
2 14 3 4 5 6	207.7	63.0	208.6	63.3	209.6	63.6	210.5	63.9	211.5	64.1	212.4	64.4	213.4	64.7	214.4	65.0	215.4	65.3	216.4	65.6	217.4	65.9	
	204.3	73.1	205.3	73.4	206.2	73.8	207.1	74.1	208.1	74.4	209.0	74.8	210.0	75.1	210.9	75.5	211.9	75.9	212.9	76.3	213.9	76.7	
	200.5	83.0	201.4	83.4	202.3	83.8	203.3	84.2	204.2	84.6	205.1	85.0	206.0	85.3	207.0	85.7	208.0	86.1	209.0	86.5	210.0	86.9	
	196.2	92.8	197.1	93.2	198.0	93.6	198.9	94.1	199.8	94.5	200.7	94.9	201.6	95.4	202.5	95.8	203.5	96.3	204.4	96.8	205.4	97.3	
	191.4	102.3	192.3	102.8	193.1	103.2	194.0	103.7	194.9	104.2	195.8	104.6	196.7	105.1	197.6	105.6	198.6	106.1	199.6	106.6	200.6	107.1	
3 14 3 4 5 6	186.1	111.6	187.0	112.1	187.8	112.6	188.7	113.1	189.6	113.6	190.4	114.1	191.3	114.6	192.1	115.2	193.1	115.6	196.6	116.1	197.6	117.1	
	180.4	120.6	181.3	121.1	182.1	121.7	182.9	122.2	183.7	122.8	184.6	123.3	185.4	123.9	186.2	124.4	187.3	125.0	188.4	125.6	189.5	126.3	
	174.3	129.3	175.1	129.9	175.9	130.5	176.7	131.1	177.5	131.7	178.3	132.2	179.1	132.8	179.9	133.4	180.8	134.1	181.9	134.8	182.9	135.6	
	167.7	137.7	168.5	138.3	169.3	138.9	170.1	139.6	170.8	140.2	171.6	140.8	172.4	141.5	173.1	142.1	174.0	142.7	175.9	143.4	176.6	144.1	
	160.8	145.7	161.5	146.4	162.3	147.1	163.0	147.7	163.7	148.4	164.5	149.1	165.2	149.7	166.0	150.4	167.0	151.1	168.1	151.8	169.2	152.5	
4 14 3 4 5 6	153.4	153.4	154.1	154.1	154.9	154.9	155.6	155.6	156.3	156.3	157.0	157.0	157.7	157.7	158.4	158.4	159.1	159.1	159.8	159.8	160.5	160.5	
	217.0	03.8	218.0	03.8	219.0	03.8	220.0	03.8	221.0	03.9	222.0	03.9	223.0	03.9	224.0	03.9	225.0	03.9	226.0	03.9	227.0	03.9	
	216.9	07.6	217.9	07.6	218.9	07.6	219.9	07.7	220.9	07.7	221.9	07.7	222.9	07.8	223.9	07.8	224.9	07.8	225.9	07.8	226.9	07.8	
	216.7	11.4	217.7	11.4	218.7	11.5	219.7	11.5	220.7	11.6	221.7	11.6	222.7	11.7	223.7	11.7	224.7	11.7	225.7	11.7	226.7	11.7	
	216.5	15.1	217.5	15.2	218.5	15.3	219.5	15.3	220.5	15.4	221.5	15.5	222.5	15.6	223.5	15.6	224.5	15.6	225.5	15.6	226.5	15.6	
5	216.2	18.9	217.2	19.0	218.2	19.1	219.2	19.2	220.2	19.3	221.2	19.3	222.2	19.4	223.2	19.5	224.2	19.5	225.2	19.5	226.2	19.5	
6	215.8	22.7	216.8	22.8	217.8	22.9	218.8	23.0	219.8	23.1	220.8	23.2	221.8	23.3	222.8	23.4	223.8	23.4	224.8	23.4	225.8	23.4	
7	215.4	26.4	216.4	26.6	217.4	26.7	218.4	26.8	219.4	26.9	220.4	27.1	221.4	27.2	222.4	27.3	223.4	27.3	224.4	27.3	225.4	27.3	
8	214.9	30.2	215.9	30.3	216.9	30.5	217.9	30.6	218.8	30.8	219.8	30.9	220.8	31.0	221.8	31.2	222.8	31.2	223.8	31.2	224.8	31.2	
9	214.3	33.9	215.3	34.1	216.3	34.3	217.3	34.4	218.3	34.6	219.3	34.7	220.3	34.9	221.3	35.0	222.3	35.0	223.3	35.0	224.3	35.0	
10	213.7	37.7	214.7	37.9	215.7	38.0	216.7	38.2	217.6	38.4	218.6	38.5	219.6	38.7	220.6	38.9	221.6	38.9	222.6	38.9	223.6	38.9	
11	213.0	41.4	214.0	41.6	215.0	41.8	216.0	42.0	216.9	42.2	217.9	42.4	218.9	42.6	219.9	42.7	220.9	42.7	221.9	42.7	222.9	42.7	
12	212.3	45.1	213.2	45.3	214.2	45.5	215.2	45.7	216.2	45.9	217.1	46.2	218.1	46.4	219.1	46.6	220.1	46.6	221.1	46.6	222.1	46.6	
13	211.4	48.8	212.4	49.0	213.4	49.3	214.4	49.5	215.3	49.7	216.3	49.9	217.3	50.2	218.3	50.4	219.3	50.4	220.3	50.4	221.3	50.4	
14	210.6	52.5	211.5	52.7	212.5	53.0	213.5	53.2	214.4	53.5	215.4	53.7	216.4	53.9	217.4	54.2	218.4	54.2	219.4	54.2	220.4	54.2	
15	209.6	56.2	210.6	56.4	211.5	56.7	212.5	56.9	213.5	57.2	214.4	57.5	215.4	57.7	216.4	58.0	217.4	58.0	218.4	58.0	219.4	58.0	
16	208.6	59.8	209.6	60.1	210.5	60.4	211.5	60.6	212.4	60.9	213.4	61.2	214.4	61.5	215.3	61.7	216.3	61.7	217.3	61.7	218.3	61.7	
17	207.5	63.4	208.5	63.7	209.4	64.0	210.4	64.3	211.3	64.6	212.3	64.9	213.3	65.2	214.2	65.5	215.2	65.5	216.2	65.5	217.2	65.5	
18	206.4	67.1	207.3	67.4	208.3	67.7	209.2	68.0	210.2	68.3	211.1	68.6	212.1	68.9	213.0	69.2	214.0	69.2	215.0	69.2	216.0	69.2	
19	205.2	70.6	206.1	71.0	207.1	71.3	208.0	71.6	209.0	72.0	209.9	72.3	210.9	72.6	211.8	72.9	212.8	72.9	213.8	72.9	214.8	72.9	
20	203.9	74.2	204.9	74.6	205.8	74.9	206.7	75.2	207.7	75.6	208.6	75.9	209.6	76.3	210.5	76.6	211.5	76.6	212.5	76.6	213.5	76.6	
21	202.6	77.8	203.5	78.1	204.5	78.5	205.4	78.8	206.3	79.2	207.3	79.6	208.2	79.9	209.1	80.3	210.1	80.3	211.1	80.3	212.1	80.3	
22	201.2	81.3	202.1	81.7	203.1	82.0	204.0	82.4	204.9	82.8	205.8	83.2	206.8	83.5	207.7	83.9	208.7	83.9	209.7	83.9	210.7	83.9	
23	199.7	84.8	200.7	85.2	201.6	85.6	202.5	86.0	203.4	86.4	204.4	86.7	205.3	87.1	206.2	87.5	207.2	87.5	208.2	87.5	209.2	87.5	
24	198.2	88.3	199.2	88.7	200.1	89.1	201.0	89.5	201.9	89.9	202.8	90.3	203.7	90.7	204.6	91.1	205.6	91.1	206.6	91.1	207.6	91.1	
25	196.7	91.7	197.6	92.1	198.5	92.6	199.4	93.0	200.3	93.4	201.2	93.8	202.1	94.2	203.0	94.7	204.0	94.7	205.0	94.7	206.0	94.7	
26	195.0	95.1	195.9	95.6	196.8	96.0	197.7	96.4	198.6	96.9	199.5	97.3	200.4	97.8	201.3	98.2	202.2	98.2	203.2	98.2	204.2	98.2	
27	193.3	98.5	194.2	99.0	195.1	99.4	196.0	99.9	196.9	100.3	197.8	100.8	198.7	101.2	199.6	101.7	200.5	101.7	201.5	101.7	202.5	101.7	
28	191.6	101.9	192.5	102.3	193.4	102.8	194.2	103.3	195.1	103.8	196.0	104.2	196.9	104.7	197.8	105.2	198.7	105.2	199.7	105.2	200.7	105.2	
29	189.8	105.2	190.7	105.7	191.5	106.2	192.4	106.7	193.3	107.1	194.2	107.6	195.0	108.1	195.9	108.6	196.1	108.6	197.1	108.6	198.1	108.6	
30	187.9	108.5	188.8	109.0	189.7	109.5	190.5	110.0	191.4	110.5	192.3	111.0	193.1	111.5	194.0	112.0	194.5	111.5	195.5	111.5	196.5	111.5	
31	186.0	111.8	186.9	112.3	187.7	112.8	188.6	113.3	189.4	113.8	190.3	114.3	191.1	114.9	192.0	115.4	192.5	114.9	193.5	114.9	194.5	114.9	
32	184.0	115.0	184.9	115.5	185.7	116.1	186.6	116.6	187.4	117.1	188.3	117.6	189.1	118.2	190.0	118.7	190.5	118.2	191.5	118.2	192.5	118.2	
33	182.0	118.2	182.8	118.7	183.7	119.3	184.5																

Traverse Table.

(x.)

Distance. 225			226			227			228			229			230			231			232		
Crsr	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crsr		
1	224.7	11.0	225.7	11.1	226.7	11.1	227.7	11.2	228.7	11.2	229.7	11.3	230.7	11.3	231.7	11.4	232.7	11.4	233.7	11.4	1		
2	223.9	22.1	224.9	22.2	225.9	22.2	226.9	22.3	227.9	22.4	228.9	22.5	229.9	22.6	230.9	22.7	231.9	22.8	232.9	22.8	2		
3	222.6	33.0	223.6	33.2	224.6	33.3	225.6	33.4	226.6	33.6	227.6	33.7	228.6	33.9	229.6	34.0	230.6	34.1	231.6	34.1	3		
4	220.7	43.9	221.7	44.1	222.6	44.3	223.6	44.5	224.6	44.7	225.6	44.9	226.6	45.1	227.5	45.3	228.5	45.4	229.5	45.4	4		
5	218.3	54.7	219.2	54.9	220.2	55.2	221.2	55.4	222.1	55.6	223.1	55.9	224.1	56.1	225.1	56.4	226.1	56.5	227.1	56.5	5		
6	215.3	65.3	216.3	65.6	217.2	65.9	218.2	66.2	219.1	66.5	220.1	66.8	221.1	67.0	222.0	67.3	223.0	67.4	224.0	67.4	6		
7	211.8	75.8	212.8	76.1	213.7	76.5	214.7	76.8	215.6	77.1	216.5	77.5	217.5	77.8	218.4	78.2	219.4	78.3	220.4	78.3	7		
8	207.9	86.1	208.8	86.5	209.7	86.9	210.6	87.3	211.6	87.6	212.5	88.0	213.4	88.4	214.3	88.8	215.3	88.8	216.3	88.8	8		
9	203.4	96.2	204.3	96.6	205.2	97.1	206.1	97.5	207.0	97.9	207.9	98.3	208.8	98.8	209.7	99.2	210.7	99.2	211.7	99.2	9		
10	198.4	106.1	199.3	106.5	200.2	107.0	201.1	107.5	202.0	107.9	202.8	108.4	203.7	108.9	204.6	109.4	210.6	109.4	211.6	109.4	10		
11	193.0	115.7	193.8	116.2	194.7	116.7	195.6	117.2	196.4	117.7	197.3	118.2	198.1	118.8	199.0	119.3	200.2	119.3	201.4	119.3	11		
12	187.1	125.0	187.9	125.6	188.7	126.1	189.6	126.7	190.4	127.2	191.2	127.8	192.1	128.3	192.9	128.5	193.7	128.5	194.9	128.5	12		
13	180.7	134.0	181.5	134.6	182.3	135.2	183.1	135.8	183.9	136.4	184.7	137.0	185.5	137.6	186.3	138.2	187.5	138.2	189.7	138.2	13		
14	173.9	142.7	174.7	143.4	175.5	144.0	176.2	144.6	177.0	145.3	177.8	145.9	178.6	146.5	179.3	147.2	180.5	147.2	182.7	147.2	14		
15	166.7	151.1	167.4	151.8	168.2	152.4	168.9	153.1	169.7	153.8	170.4	154.5	171.2	155.1	171.9	155.8	182.7	155.8	184.9	155.8	15		
16	159.1	159.1	159.8	159.8	160.5	160.5	161.2	161.2	161.9	161.9	162.6	162.6	163.3	163.3	164.0	164.0	164.7	164.0	165.4	164.0	16		
17	225.0	03.9	226.0	03.9	227.0	04.0	228.0	04.0	229.0	04.0	230.0	04.0	231.0	04.0	232.0	04.0	233.0	04.0	234.0	04.0	17		
18	224.9	07.9	225.9	07.9	226.9	07.9	227.9	08.0	228.9	08.0	229.9	08.0	230.9	08.0	231.9	08.1	232.9	08.1	233.9	08.1	18		
19	224.7	11.8	225.7	11.8	226.7	11.9	227.7	11.9	228.7	12.0	229.7	12.0	230.7	12.0	231.7	12.1	232.7	12.1	233.7	12.1	19		
20	224.5	15.7	225.4	15.8	226.4	15.8	227.4	15.9	228.4	16.0	229.4	16.0	230.4	16.1	231.4	16.2	232.4	16.2	233.4	16.2	20		
21	224.1	19.6	225.1	19.7	226.1	19.8	227.1	19.9	228.1	20.0	229.1	20.0	230.1	20.1	231.1	20.2	232.1	20.2	233.1	20.2	21		
22	223.8	23.5	224.8	23.6	225.8	23.7	226.8	23.8	227.7	23.9	228.7	24.0	229.7	24.1	230.7	24.3	231.7	24.3	232.7	24.3	22		
23	223.3	27.4	224.3	27.5	225.3	27.7	226.3	27.8	227.3	27.9	228.3	28.0	229.3	28.1	230.3	28.3	231.3	28.3	232.3	28.3	23		
24	222.8	31.3	223.8	31.5	224.8	31.6	225.8	31.7	226.8	31.9	227.8	32.0	228.8	32.1	229.7	32.3	230.7	32.3	231.7	32.3	24		
25	222.2	35.2	223.2	35.4	224.2	35.5	225.2	35.7	226.2	35.8	227.2	36.0	228.2	36.1	229.1	36.3	230.1	36.3	231.1	36.3	25		
26	221.6	39.1	222.6	39.2	223.6	39.4	224.5	39.6	225.5	39.8	226.5	39.9	227.5	40.1	228.5	40.3	229.5	40.3	230.5	40.3	26		
27	220.9	42.9	221.8	43.1	222.8	43.3	223.8	43.5	224.8	43.7	225.8	43.9	226.8	44.1	227.7	44.3	228.7	44.3	229.7	44.3	27		
28	220.1	46.8	221.1	47.0	222.0	47.2	223.0	47.4	224.0	47.6	225.0	47.8	226.0	48.0	226.9	48.2	227.9	48.2	228.9	48.2	28		
29	219.2	50.6	220.2	50.8	221.2	51.1	222.2	51.3	223.1	51.5	224.1	51.7	225.1	52.0	226.1	52.2	227.1	52.2	228.1	52.2	29		
30	218.3	54.4	219.3	54.7	220.3	54.9	221.2	55.2	222.2	55.4	223.2	55.6	224.1	55.9	225.1	56.1	226.1	56.1	227.1	56.1	30		
31	217.3	58.2	218.3	58.5	219.3	58.8	220.2	59.0	221.2	59.2	222.2	59.5	223.2	59.8	224.1	60.0	225.1	60.0	226.1	60.0	31		
32	216.3	62.0	217.2	62.3	218.2	62.6	219.2	62.8	220.1	63.1	221.1	63.4	222.1	63.7	223.0	63.9	224.0	63.9	225.0	63.9	32		
33	215.2	65.8	216.1	66.1	217.1	66.4	218.0	66.7	219.0	67.0	220.0	67.2	220.9	67.5	221.9	67.8	222.9	67.8	223.9	67.8	33		
34	214.0	69.5	214.9	69.8	215.9	70.1	216.8	70.5	217.8	70.8	218.7	71.1	219.7	71.4	220.6	71.7	221.6	71.7	222.6	71.7	34		
35	212.7	73.3	213.7	73.6	214.6	73.9	215.6	74.2	216.5	74.6	217.5	74.9	218.4	75.2	219.4	75.5	220.4	75.5	221.4	75.5	35		
36	211.4	77.0	212.4	77.3	213.3	77.6	214.2	78.0	215.2	78.3	216.1	78.7	217.1	79.0	218.0	79.3	219.0	79.3	220.0	79.3	36		
37	210.1	80.6	211.0	81.0	211.9	81.3	212.9	81.7	213.8	82.1	214.7	82.4	215.7	82.8	216.6	83.1	217.6	83.1	218.6	83.1	37		
38	208.6	84.3	209.5	84.7	210.5	85.0	211.4	85.4	212.3	85.8	213.3	86.2	214.2	86.5	215.1	86.9	216.6	86.9	217.6	86.9	38		
39	207.1	87.9	208.0	88.3	209.0	88.7	209.9	89.1	210.8	89.5	211.7	89.9	212.6	90.3	213.6	90.6	214.6	90.6	215.6	90.6	39		
40	205.5	91.5	206.5	91.9	207.4	92.3	208.3	92.7	209.2	93.1	210.1	93.5	211.0	94.0	211.9	94.4	212.9	94.4	213.9	94.4	40		
41	203.9	95.1	204.8	95.5	205.7	95.9	206.6	96.4	207.5	96.8	208.5	97.2	209.4	97.6	210.3	98.0	211.3	98.0	212.3	98.0	41		
42	202.2	98.6	203.1	99.1	204.0	99.5	204.9	99.9	205.8	100.4	206.7	100.8	207.6	101.3	208.5	101.7	209.7	101.7	210.7	101.7	42		
43	200.5	102.1	201.4	102.6	202.3	103.1	203.1	103.5	204.0	104.0	204.9	104.4	205.8	104.9	206.7	105.3	207.7	105.3	208.7	105.3	43		
44	198.7	105.6	199.5	106.1	200.4	106.6	201.3	107.0	202.2	107.5	203.1	108.0	204.0	108.4	204.8	108.9	210.2	108.9	211.2	108.9	44		
45	196.8	109.1	197.7	109.6	198.5	110.1	199.4	110.5	200.3	111.0	201.2	111.5	202.0	112.0	202.9	112.5	203.8	112.5	204.1	112.5	45		
46	194.9	112.5	195.7	113.0	196.6	113.5	197.5	114.0	198.3	114.5	199.2	115.0	200.1	115.5	200.9	116.0	201.9	116.0	202.9	116.0	46		
47	192.9	115.9	193.7	116.4	194.6	116.9	195.4	117.4	196.3	117.9	197.1	118.5	198.0	119.0	199.8	119.5	200.9	119.5	201.9	119.5	47		
48	190.8	119.2	191.7	119.8	192.5	120.3	193.4	120.8	194.2	121.4	195.1	121.9	195.9	122.4	196.7	122.9	200.5	122.9	201.5	122.9	48		
49	188.7	122.5	189.5	123.1	190.4	123.6	191.2	124.2	192.1	124.7	192.9	125.3	193.7	125.8	194.6	126.4	200.5	126.4	201.5	126.4	49		
50	186.5	125.8	187.4	126.4	188.2	126.9	189.0	127.5	189.8	128.1	190.7	128.6	191.5	129.2	192.3	129.7	200.5	129.7	201.5	129.7	50		
51	184.3	129.1	185.1	129.6	185.9	129.2	186.8	130.8	187.6	131.3	188.4	131.9	189.2	132.5	190.0	133.1	200.5	133.1	201.5	133.1	51		
52	182.0	132.3	182.8	132.8	183.6	133.4	184.5	134.0	185.3	134.6	186.1	135.2	186.9	135.8	187.7	136.4	200.5	136.4	201.5	136.4	52		
53	179.7	135.4	180.5	136.0	181.3	136.6	182.1	137.2	182.9	137.8	183.7	138.4	184.5	139.0	185.3	139.6	200.5	139.6	201.5	139.6	53		
54	177.3	138.5	178.1	139.1	178.9	139.8	179.7	140.4	180.5	141.0	181.2	141.6	182.0	142.2	182.8	142.8	200.5	142.8	201.5	142.8	54		
55	174.9	141.6	175.6	142.2	176.4	143.9	177.2	143.5	178.0	144.1	178.7	144.7	179.5	145.4	180.3	146.0	200.5	146.0	201.5	146.0	55		
56	172.4	144.6	173.1	145.3	173.9	145.9	174.7	146.6	175.4	147.2	176.2	147.8	177.0	148.5	177.7	149.1	200.5	177.7	201.5	149.1	56		
57	169.8	147.6	170.6	148.3	171.3	148.9	172.1	149.6	172.8	150.2	173.6	150.9	174.3	151.5	175.1	152.2	200.5	175.1	201.5	152.2	57		
58	167.2	150.6	168.0	151.2	168.7	151.																	

Traverse Table.

(x.)

Distance. 233		234		235		236		237		238		239		240		Crs.	
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	
1	232.7	11.4	233.7	11.5	234.7	11.5	235.7	11.6	236.7	11.6	237.7	11.7	238.7	11.7	239.7	11.8	7
2	231.9	22.8	232.9	22.9	233.9	23.0	234.9	23.1	235.9	23.2	236.9	23.3	237.8	23.4	238.8	23.5	8
3	230.5	34.2	231.5	34.3	232.4	34.5	233.4	34.6	234.4	34.8	235.4	34.9	236.4	35.1	237.4	35.2	9
4	228.5	45.5	229.5	45.7	230.5	45.8	231.5	46.0	232.4	46.2	233.4	46.4	234.4	46.6	235.4	46.8	10
5	226.0	56.6	227.0	56.9	228.0	57.1	228.9	57.3	229.9	57.6	230.9	57.8	231.8	58.1	232.8	58.3	11
6	223.0	67.6	223.9	67.9	224.9	68.2	225.8	68.5	226.8	68.8	227.8	69.1	228.7	69.4	229.7	69.7	12
7	219.4	78.5	220.3	78.8	221.3	79.2	222.2	79.5	223.1	79.8	224.1	80.2	225.0	80.5	226.0	80.8	13
8	215.3	89.2	216.2	89.6	217.1	89.9	218.0	90.3	219.0	90.7	219.9	91.1	220.8	91.5	221.7	91.8	14
9	210.6	99.6	211.5	100.1	212.4	100.5	213.3	100.9	214.2	101.3	215.1	101.8	216.1	102.2	217.0	102.6	15
10	205.5	109.8	206.4	110.3	207.3	110.8	208.1	111.2	209.0	111.7	209.9	112.2	210.8	112.7	211.7	113.1	16
11	199.8	119.8	200.7	120.3	201.6	120.8	202.4	121.3	203.3	121.8	204.1	122.4	205.0	122.9	205.9	123.4	17
12	193.7	129.4	194.6	130.0	195.4	130.6	196.2	131.1	197.1	131.7	197.9	132.2	198.7	132.8	199.5	133.3	18
13	187.1	138.8	187.9	139.4	188.8	140.0	189.6	140.6	190.4	141.2	191.2	141.8	192.0	142.4	192.8	143.0	19
14	180.1	147.8	180.9	148.4	181.7	149.1	182.4	149.7	183.2	150.3	184.0	151.0	184.7	151.6	185.5	152.3	20
15	172.6	156.5	173.4	157.1	174.1	157.8	174.9	158.5	175.6	159.1	176.3	159.8	177.1	160.5	177.8	161.2	21
16	164.8	164.8	165.5	165.5	166.2	166.2	166.9	166.9	167.6	167.6	168.3	168.3	169.0	169.0	169.7	169.7	22
17	233.0	04.1	234.0	04.1	235.0	04.1	236.0	04.1	237.0	04.1	238.0	04.2	239.0	04.2	240.0	04.2	23
18	232.9	08.1	233.9	08.2	234.9	08.2	235.9	08.2	236.9	08.3	237.9	08.3	238.9	08.3	239.9	08.4	24
19	232.7	12.2	233.7	12.2	234.7	12.3	235.7	12.4	236.7	12.4	237.7	12.5	238.7	12.5	239.7	12.6	25
20	232.4	16.3	233.4	16.3	234.4	16.4	235.4	16.5	236.4	16.5	237.4	16.6	238.4	16.7	239.4	16.7	26
21	232.1	20.3	233.1	20.4	234.1	20.5	235.1	20.6	236.1	20.7	237.1	20.7	238.1	20.8	239.1	20.9	27
22	231.7	24.4	232.7	24.5	233.7	24.6	234.7	24.7	235.7	24.8	236.7	24.9	237.7	25.0	238.7	25.1	28
23	231.3	28.4	232.3	28.5	233.2	28.6	234.2	28.8	235.2	28.9	236.2	29.0	237.2	29.1	238.2	29.2	29
24	230.7	32.4	231.7	32.6	232.7	32.7	233.7	32.8	234.7	33.0	235.7	33.1	236.7	33.3	237.7	33.4	30
25	230.1	36.4	231.1	36.6	232.1	36.8	233.1	36.9	234.1	37.1	235.1	37.2	236.1	37.4	237.0	37.5	31
26	229.5	40.5	230.4	40.6	231.4	40.8	232.4	41.0	233.4	41.2	234.4	41.3	235.4	41.5	236.4	41.7	32
27	228.7	44.5	229.7	44.6	230.7	44.8	231.7	45.0	232.6	45.2	233.6	45.4	234.6	45.6	235.6	45.8	33
28	227.9	48.4	228.9	48.7	229.9	48.9	230.8	49.1	231.8	49.3	232.8	49.5	233.8	49.7	234.8	49.9	34
29	227.0	52.4	228.0	52.6	229.0	52.9	230.0	53.1	230.9	53.3	231.9	53.5	232.9	53.8	233.8	54.0	35
30	226.1	56.4	227.0	56.6	228.0	56.9	229.0	57.1	230.0	57.3	230.9	57.6	231.9	57.8	232.9	58.1	36
31	225.1	60.3	226.0	60.6	227.0	60.8	228.0	61.1	228.9	61.3	229.9	61.6	230.9	61.9	231.8	62.1	37
32	224.0	64.2	224.9	64.5	225.9	64.8	226.9	65.1	227.8	65.3	228.8	65.6	229.7	65.9	230.7	66.2	38
33	222.8	68.1	223.8	68.4	224.7	68.7	225.7	69.0	226.6	69.3	227.6	69.6	228.6	69.9	229.5	70.2	39
34	221.6	72.0	222.5	72.3	223.5	72.6	224.4	72.9	225.4	73.2	226.4	73.5	227.3	73.9	228.3	74.2	40
35	220.3	75.9	221.3	76.2	222.2	76.5	223.1	76.8	224.1	77.2	225.0	77.5	226.0	77.8	226.9	78.1	41
36	218.9	79.7	219.9	80.0	220.8	80.4	221.8	80.7	222.7	81.1	223.6	81.4	224.6	81.7	225.5	82.1	42
37	217.5	83.5	218.5	83.9	219.4	84.2	220.3	84.6	221.3	84.9	222.2	85.3	223.1	85.6	224.1	86.0	43
38	216.0	87.3	217.0	87.7	217.9	88.0	218.8	88.4	219.7	88.8	220.7	89.2	221.6	89.5	222.5	89.9	44
39	214.5	91.0	215.4	91.4	216.3	91.8	217.2	92.2	218.2	92.6	219.1	93.0	220.0	93.4	220.9	93.8	45
40	212.9	94.8	213.8	95.2	214.7	95.6	215.6	96.0	216.5	96.4	217.4	96.8	218.3	97.2	219.3	97.6	46
41	211.2	98.5	212.1	98.9	213.0	99.3	213.9	99.7	214.8	100.2	215.7	100.6	216.6	101.0	217.5	101.4	47
42	209.4	102.1	210.3	102.6	211.2	103.0	212.1	103.5	213.0	103.9	213.9	104.3	214.8	104.8	215.7	105.2	48
43	207.6	105.8	208.5	106.2	209.4	106.7	210.3	107.1	211.2	107.6	212.1	108.0	213.0	108.5	213.8	109.0	49
44	205.7	109.4	206.6	109.9	207.5	110.3	208.4	110.8	209.3	111.3	210.1	111.7	211.0	112.2	211.9	112.7	50
45	203.8	113.0	204.7	113.4	205.5	113.9	206.4	114.4	207.3	114.9	208.2	115.4	209.0	115.9	209.9	116.4	51
46	201.8	116.5	202.6	117.0	203.5	117.5	204.4	118.0	205.2	118.5	206.1	119.0	207.0	119.5	207.8	120.0	52
47	199.7	120.0	200.6	120.5	201.4	121.0	202.3	121.5	203.1	122.1	204.0	122.6	204.9	123.1	205.7	123.6	53
48	197.6	123.5	198.4	124.0	199.3	124.5	200.1	125.1	201.0	125.6	201.8	126.1	202.7	126.7	203.5	127.2	54
49	195.4	126.9	196.2	127.4	197.1	128.0	197.9	128.5	198.8	129.1	199.6	129.6	200.4	130.2	201.3	130.7	55
50	193.2	130.3	194.0	130.9	194.8	131.4	195.7	132.0	196.5	132.5	197.3	133.1	198.1	133.6	199.0	134.2	56
51	190.9	133.6	191.7	134.2	192.5	134.8	193.3	135.4	194.1	135.9	195.0	136.5	195.8	137.1	196.6	137.5	57
52	188.5	137.0	189.3	137.5	190.1	138.1	190.9	138.7	191.7	139.3	192.5	139.9	193.4	140.5	194.2	141.1	58
53	186.1	140.2	186.9	140.8	187.7	141.4	188.5	142.0	189.3	142.6	190.1	143.2	190.9	143.8	191.7	144.4	59
54	183.6	143.4	184.4	144.1	185.2	144.7	186.0	145.3	186.8	145.9	187.5	146.5	188.3	147.1	189.1	147.8	60
55	181.1	146.6	181.9	147.3	182.6	147.9	183.4	148.5	184.2	149.1	185.0	149.8	185.7	150.4	186.5	151.0	61
56	178.5	149.8	179.3	150.4	180.0	151.1	180.8	151.7	181.6	152.3	182.3	153.0	183.1	153.6	183.9	154.3	62
57	175.8	152.9	176.6	153.5	177.4	154.2	178.1	154.8	178.9	155.5	179.6	156.1	180.4	156.8	181.1	157.5	63
58	173.2	155.9	173.9	156.6	174.6	157.2	175.4	157.9	176.1	158.6	176.9	159.3	177.6	159.9	178.4	160.6	64
59	170.4	158.9	171.1	159.6	171.9	160.3	172.6	161.0	173.3	161.6	174.1	162.3	174.8	163.0	175.5	163.7	65
60	167.6	161.9	168.3	162.6	169.0	163.2	169.8	163.9	170.5	164.6	171.2	165.3	171.9	166.0	172.6	166.7	66
61	164.8	164.8	165.5	165.5	166.2	166.2	166.9	166.9	167.6	167.6	168.3	168.3	169.0	169.0	169.7	169.7	67
62	163.0	168.1	169.0	169.0	170.0	170.0	171.0	171.0	172.0	172.0	173.0	173.0	174.0	174.0	175.0	175.0	68
63	161.2	171.3	172.2	172.2	173.2	173.2	174.2	174.2	175.2	175.2	176.2	176.2	177.2	177.2	178.2	178.2	69
64	159.4	174.5	175.4	175.4	176.4	176.4	177.4	177.4	178.4	178.4	179.4	179.4	180.4	180.4	181.4	181.4	70
65	157.6	177.7	178.6	178.6	179.6	179.6	180.6	180.6	181.6	181.6	182.6	182.6	183.6	183.6	184.6	184.6	71
66	155.8	180.9	181.8	181.8	182.8	182.8	183.8	183.8	184.8	184.8	185.8	185.8	186.8	186.8	187.8	187.8	72
67	154.0	184.1	185.0	185.0	186.0	186.0	187.0	187.0	188.0	188.0	189.0	189.0	190.0	190.0	191.0	191.0	73
68	152.2	187.3	188.2	188.2	189.2	189.2	190.2	190.2	191.2	191.							

(x.)

Traverse Table.

Distance. 241			242			243			244			245			246			247			248			Course
Pts.	Diff.	Lat	Dep.	Diff.	Lat	Dep.	Diff.	Lat	Dep.	Diff.	Lat	Dep.	Diff.	Lat	Dep.	Diff.	Lat	Dep.	Diff.	Lat	Dep.	Pts.		
1	240.7	11.8	241.7	11.9	242.7	11.9	243.7	12.0	244.7	12.0	245.7	12.1	246.7	12.1	247.7	12.2	248.7	12.2	249.7	12.2	250.7	12.2	890	
	239.8	23.6	240.8	23.7	241.8	23.8	242.8	23.9	243.8	24.0	244.8	24.1	245.8	24.2	246.8	24.3	247.8	24.3	248.8	24.3	249.8	24.3	880	
	238.4	35.4	239.4	35.5	240.4	35.7	241.4	35.8	242.3	35.9	243.3	36.1	244.3	36.2	245.3	36.4	246.3	36.4	247.3	36.4	248.3	36.4	870	
	236.4	47.0	237.3	47.2	238.3	47.4	239.3	47.6	240.3	47.8	241.3	48.0	242.3	48.2	243.2	48.4	244.2	48.4	245.2	48.4	246.2	48.4	860	
2	233.8	58.6	234.7	58.8	235.7	59.0	236.7	59.3	237.7	59.5	238.6	59.8	239.6	60.0	240.6	60.3	241.6	60.3	242.6	60.3	243.6	60.3	850	
	230.6	70.0	231.6	70.2	232.5	70.5	233.5	70.8	234.5	71.1	235.4	71.4	236.4	71.7	237.3	72.0	238.3	71.7	239.3	71.7	240.3	71.7	840	
	226.9	81.2	227.8	81.5	228.8	81.9	229.7	82.2	230.7	82.5	231.6	82.9	232.6	83.2	233.5	83.5	234.5	83.2	235.5	83.2	236.5	83.2	830	
	222.7	92.2	223.6	92.6	224.5	93.0	225.4	93.4	226.4	93.8	227.3	94.1	228.2	94.5	229.1	94.9	230.1	94.5	231.5	94.5	232.5	94.5	820	
3	217.9	103.0	218.8	103.5	219.7	103.9	220.6	104.3	221.5	104.8	222.4	105.2	223.3	105.6	224.2	106.0	225.2	105.6	226.6	105.6	227.6	105.6	810	
	212.5	113.6	213.4	114.1	214.3	114.6	215.2	115.0	216.1	115.5	217.0	116.0	217.8	116.4	218.7	116.9	219.7	116.4	220.7	116.4	221.7	116.4	800	
	206.7	123.9	207.6	124.4	208.4	124.9	209.3	125.4	210.1	125.9	211.0	126.5	211.9	127.0	212.7	127.5	213.7	126.5	214.7	126.5	215.7	126.5	790	
	200.4	133.9	201.2	134.4	202.0	135.0	202.9	135.6	203.7	136.1	204.5	136.7	205.4	137.2	206.2	137.8	207.8	136.7	208.7	136.7	209.7	136.7	780	
4	193.6	143.6	194.4	144.2	195.2	144.8	196.0	145.4	196.8	146.0	197.6	146.5	198.4	147.1	199.2	147.7	200.8	146.5	201.7	146.5	202.7	146.5	770	
	186.3	152.9	187.1	153.5	187.8	154.2	188.6	154.8	189.4	155.4	190.2	156.1	190.9	156.7	191.7	157.3	192.8	156.1	193.7	156.1	194.7	156.1	760	
	178.6	161.8	179.3	162.5	180.0	163.2	180.8	163.8	181.5	164.5	182.3	165.2	183.0	165.9	183.8	166.5	184.9	165.2	186.2	165.2	187.2	165.2	750	
	170.4	170.4	171.1	171.1	171.8	171.8	172.5	172.5	173.2	173.2	173.9	173.9	174.7	174.7	175.4	175.4	176.5	173.9	176.5	173.9	177.5	173.9	740	
5	241.0	04.2	242.0	04.2	243.0	04.2	244.0	04.3	245.0	04.3	246.0	04.3	247.0	04.5	248.0	04.3	249.0	04.5	250.0	04.5	251.0	04.5	890	
	240.9	08.4	241.9	08.4	242.9	08.5	243.9	08.5	244.9	08.6	245.9	08.6	246.8	08.6	247.8	08.7	248.8	08.6	249.8	08.7	250.8	08.7	880	
	240.7	12.6	241.7	12.7	242.7	12.7	243.7	12.8	244.7	12.8	245.7	12.9	246.7	12.9	247.7	13.0	248.7	12.9	249.7	13.0	250.7	13.0	870	
	240.4	16.8	241.4	16.9	242.4	17.0	243.4	17.0	244.4	17.1	245.4	17.2	246.4	17.2	247.4	17.3	248.4	17.2	249.4	17.3	250.4	17.3	860	
6	240.1	21.0	241.1	21.1	242.1	21.2	243.1	21.3	244.1	21.4	245.1	21.4	246.1	21.5	247.1	21.6	248.1	21.5	249.1	21.6	250.1	21.6	850	
	239.7	25.2	240.7	25.3	241.7	25.4	242.7	25.5	243.7	25.6	244.7	25.7	245.6	25.8	246.6	25.9	247.6	25.8	248.6	25.9	249.6	25.9	840	
	239.2	29.4	240.2	29.5	241.2	29.6	242.2	29.7	243.2	29.9	244.2	30.0	245.2	30.1	246.2	30.2	247.2	30.1	248.2	30.2	249.2	30.2	830	
	238.7	33.5	239.6	33.7	240.6	33.8	241.6	34.0	242.6	34.1	243.6	34.2	244.6	34.4	245.6	34.5	246.6	34.2	247.6	34.3	248.6	34.3	820	
7	238.0	37.7	239.0	37.9	240.0	38.0	241.0	38.2	242.0	38.3	243.0	38.5	244.0	38.6	244.9	38.8	245.9	38.6	246.9	38.7	247.9	38.8	810	
	237.3	41.8	238.3	42.0	239.3	42.2	240.3	42.4	241.3	42.5	242.3	42.7	243.2	42.9	244.2	43.1	245.2	42.9	246.2	43.0	247.2	43.1	800	
	236.6	46.0	237.6	46.2	238.5	46.4	239.5	46.6	240.5	46.7	241.5	46.9	242.5	47.1	243.4	47.3	244.4	47.0	245.4	47.1	246.4	47.3	790	
	235.7	50.1	236.7	50.3	237.7	50.5	238.7	50.7	239.6	50.9	240.6	51.1	241.6	51.4	242.6	51.6	243.6	51.1	244.6	51.2	245.6	51.6	780	
8	234.8	54.2	235.8	54.4	236.8	54.7	237.7	54.9	238.7	55.1	239.7	55.3	240.7	55.6	241.6	55.8	242.6	55.4	243.6	55.5	244.6	55.8	770	
	233.8	58.3	234.8	58.5	235.8	58.8	236.8	59.0	237.7	59.3	238.7	59.5	239.7	59.8	240.6	60.0	241.6	59.5	242.6	59.6	243.6	60.0	760	
	232.8	62.4	233.8	62.6	234.7	62.9	235.7	63.2	236.6	63.4	237.6	63.7	238.6	63.9	239.5	64.2	240.5	63.7	241.5	63.8	242.5	64.2	750	
	231.7	66.4	232.6	66.7	233.6	67.0	234.5	67.3	235.5	67.5	236.5	67.8	237.4	68.1	238.4	68.4	239.4	67.8	240.4	68.0	241.4	68.4	740	
9	230.5	70.5	231.4	70.8	232.4	71.0	233.3	71.3	234.3	71.6	235.3	71.9	236.2	72.2	237.2	72.5	238.2	72.0	239.2	72.1	240.2	72.5	730	
	229.2	74.5	230.2	74.8	231.1	75.1	232.1	75.4	233.0	75.7	234.0	76.0	234.9	76.3	235.9	76.6	236.7	76.0	237.7	76.1	238.7	76.6	720	
	227.9	78.5	228.8	78.8	229.8	79.1	230.7	79.4	231.7	79.8	232.6	80.1	233.5	80.4	234.5	80.7	235.5	80.1	236.5	80.2	237.5	80.7	710	
	226.5	82.4	227.4	82.8	228.3	83.1	229.3	83.5	230.2	83.8	231.2	84.1	232.1	84.5	233.0	84.8	234.0	84.1	235.0	84.2	236.0	84.8	700	
10	225.0	86.4	225.9	86.7	226.9	87.1	227.8	87.4	228.7	87.8	229.7	88.2	230.6	88.5	231.5	88.9	232.5	88.2	233.5	88.3	234.5	88.9	690	
	223.5	90.3	224.4	90.7	225.3	91.0	226.2	91.4	227.2	91.8	228.1	92.2	229.0	92.5	230.9	92.9	231.8	92.2	233.2	92.3	234.2	92.9	680	
	221.8	94.2	222.8	94.6	223.7	94.9	224.6	95.3	225.5	95.7	226.4	96.1	227.4	96.5	228.3	96.9	229.2	96.1	231.1	96.2	232.0	96.9	670	
	220.2	98.0	221.1	98.4	222.0	98.8	222.9	99.2	223.8	99.7	224.7	100.1	225.6	100.5	226.5	100.9	227.4	100.1	232.1	100.2	233.0	100.9	660	
11	215.8	101.9	219.3	102.3	220.2	102.7	221.1	103.1	222.0	103.5	223.0	104.0	223.9	104.4	224.8	104.8	225.7	104.0	225.9	104.1	226.8	104.8	650	
	216.6	105.6	217.5	106.1	218.4	106.5	219.3	107.0	220.2	107.4	221.1	107.8	222.0	108.3	222.9	108.7	223.8	107.8	224.7	107.9	225.6	108.7	640	
	214.7	109.4	215.6	109.9	216.5	110.3	217.4	110.8	218.3	111.2	219.2	111.7	220.1	112.1	221.0	112.6	223.1	111.7	223.6	111.8	224.5	112.6	630	
	212.8	113.1	213.7	113.6	214.6	114.1	215.4	114.6	216.3	115.0	217.2	115.5	218.1	116.0	219.0	116.4	220.4	115.5	222.4	115.6	223.3	116.4	620	
12	210.8	116.8	211.7	117.3	212.5	117.8	213.4	118.3	214.3	118.8	215.2	119.3	216.0	119.7	216.9	120.2	217.8	119.7	220.7	119.8	221.6	120.2	610	
	208.7	120.5	209.6	121.0	210.4	121.5	211.3	122.0	212.2	122.5	213.0	123.0	213.9	123.5	214.8	124.0	215.0	123.9	220.9	124.0	221.0	124.0	600	
	206.6	124.1	207.4	124.6	208.3	125.2	209.1	125.7	210.0	126.2	210.9	126.7	211.9	127.1	212.2	127.5	213.0	127.1	222.1	127.2	223.1	127.5	590	
	204.4	127.7	205.2	128.2	206.1	128.8	206.9	129.3	207.8	129.8	208.6	130.4	209.5	130.9	210.3	131.4	212.4	130.4	221.4	130.5	222.3	131.4	580	
13	202.1	131.3	203.0	131.8	203.8	132.3	204.6	132.9	205.5	133.4	206.3	134.0	207.2	134.5	208.0	135.1	209.7	134.5	222.7	134.6	223.6	135.1	570	
	199.8	134.8	200.6	135.3	201.1	135.9	202.3	136.4	203.1	137.0	203.9	137.6	204.4	138.1	205.6	138.7	206.5	138.1	224.5	138.2	225.5	138.7	560	
	197.4	138.2	198.2	138.8	199.1	139.4	199.9	140.0	200.7	140.5	201.5	141.1	202.3	141.7	203.1	142.2	204.5	141.7	226.4	141.8	227.3	142.2	550	
	195.0	141.7	195.8	142.2	196.6	142.8	197.4	143.4	198.2	144.0	199.0	144.6	199.8	145.2	200.6	145.8	201.4	145.2	228.2	145.3	229.1	145.8	540	
14	192.5	145.0	193.3	145.6	194.1	146.2	194.9	146.8	195.7	147.4	196.5	148.0	197.3	148.6	198.1	149.3	200.0	148.6	230.0	148.7	230.9	149.3	530	
	189.9	148.4	190.7	149.0	191.5	149.																		

Traverse Table.

(x.)

Distance. 249			250			251			252			253			254			255			256			Crs.
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.	
1	248.7	12.2	249.7	12.3	250.7	12.3	251.7	12.4	252.7	12.4	253.7	12.5	254.7	12.5	255.7	12.6	256.7	12.6	257.7	12.6	258.7	12.6	7	
2	247.8	24.4	248.8	24.5	249.8	24.6	250.8	24.7	251.8	24.8	252.8	24.9	253.8	25.0	254.8	25.1	255.8	25.1	256.8	25.2	257.8	25.2	8	
3	246.3	36.5	247.3	36.7	248.3	36.8	249.3	37.0	250.3	37.1	251.2	37.3	252.2	37.4	253.2	37.6	254.2	37.7	255.2	37.8	256.2	37.9	9	
4	244.2	48.6	245.2	48.8	246.2	49.0	247.2	49.2	248.1	49.4	249.1	49.6	250.1	49.7	251.1	49.9	252.1	50.0	253.1	50.1	254.1	50.2	10	
5	241.5	60.5	242.5	60.7	243.5	61.0	244.5	61.2	245.4	61.5	246.4	61.7	247.4	62.0	248.3	62.2	249.3	62.4	250.3	62.6	251.3	62.8	11	
6	238.3	72.3	239.2	72.6	240.2	72.9	241.2	73.1	242.1	73.4	243.1	73.7	244.0	74.0	245.0	74.3	246.0	74.5	247.0	74.8	248.0	75.0	12	
7	234.4	83.9	235.4	84.2	236.3	84.6	237.3	84.9	238.2	85.2	239.1	85.6	240.1	85.9	241.0	86.2	242.0	86.4	243.0	86.7	244.0	87.0	13	
8	230.1	95.3	231.0	95.7	231.9	96.1	232.8	96.4	233.7	96.8	234.7	97.2	235.6	97.6	236.5	98.0	237.4	98.3	239.3	98.7	240.2	99.0	14	
9	225.1	106.5	226.0	106.9	226.9	107.3	227.8	107.8	228.7	108.2	229.6	108.6	230.5	109.0	231.4	109.5	232.3	109.8	233.2	110.2	234.1	110.5	15	
10	219.6	117.4	220.5	117.8	221.4	118.3	222.2	118.8	223.1	119.3	224.0	119.7	224.9	120.2	225.8	120.7	226.7	121.0	227.6	121.4	228.5	121.8	16	
11	213.6	128.0	214.4	128.5	215.3	129.0	216.1	129.5	217.0	130.1	217.9	130.6	218.7	131.1	219.6	131.6	220.5	131.9	222.9	132.3	223.8	132.6	17	
12	207.0	138.3	207.9	138.9	208.7	139.4	209.5	140.0	210.4	140.6	211.2	141.1	212.0	141.7	212.9	142.2	213.8	142.9	214.7	143.1	215.2	143.4	18	
13	200.0	148.3	200.8	148.9	201.6	149.5	202.4	150.1	203.2	150.7	204.0	151.3	204.8	151.9	205.6	152.5	206.5	153.4	207.4	154.3	208.3	155.2	19	
14	192.5	158.0	193.2	158.6	194.0	159.2	194.8	159.9	195.6	160.5	196.3	161.1	197.1	161.8	197.9	162.4	198.9	163.8	199.8	164.7	200.7	165.6	20	
15	184.5	167.2	185.2	167.9	186.0	168.5	186.7	169.2	187.5	169.9	188.2	170.6	188.9	171.2	189.7	171.9	190.6	172.8	191.7	173.6	192.8	174.5	21	
16	176.1	176.1	176.8	176.8	177.5	177.5	178.2	178.2	178.9	178.9	179.6	179.6	180.3	180.3	181.0	181.0	181.7	181.7	182.4	182.4	183.1	183.1	22	
17	249.0	04.3	250.0	04.4	251.0	04.4	252.0	04.4	253.0	04.4	254.0	04.4	255.0	04.5	256.0	04.5	257.0	04.5	258.0	04.5	259.0	04.5	23	
18	248.8	08.7	249.8	08.7	250.8	08.8	251.8	08.8	252.8	08.8	253.8	08.9	254.8	08.9	255.8	08.9	256.8	08.9	257.8	08.9	258.8	08.9	24	
19	248.7	13.0	249.7	13.1	250.7	13.1	251.7	13.2	252.7	13.2	253.7	13.3	254.7	13.3	255.7	13.4	256.7	13.4	257.7	13.4	258.7	13.4	25	
20	248.4	17.4	249.4	17.4	250.4	17.5	251.4	17.6	252.4	17.6	253.4	17.7	254.4	17.8	255.4	17.9	256.4	17.9	257.4	17.9	258.4	17.9	26	
21	248.1	21.7	249.0	21.8	250.0	21.9	251.0	22.0	252.0	22.1	253.0	22.1	254.0	22.2	255.0	22.3	256.0	22.3	257.0	22.3	258.0	22.3	27	
22	247.6	26.0	248.6	26.1	249.6	26.2	250.6	26.3	251.6	26.4	252.6	26.6	253.6	26.7	254.6	26.8	255.6	26.8	256.6	26.8	257.6	26.8	28	
23	247.1	30.3	248.1	30.5	249.1	30.6	250.1	30.7	251.1	30.8	252.1	31.0	253.1	31.1	254.1	31.2	255.1	31.2	256.1	31.2	257.1	31.2	29	
24	246.6	34.7	247.6	34.8	248.6	34.9	249.5	35.1	250.5	35.2	251.5	35.3	252.5	35.5	253.5	35.6	254.5	35.6	255.5	35.6	256.5	35.6	30	
25	245.9	39.0	246.9	39.1	247.9	39.3	248.9	39.4	249.9	39.6	250.9	39.7	251.9	39.9	252.8	40.0	253.8	40.1	254.8	40.1	255.8	40.1	31	
26	245.2	43.2	246.2	43.4	247.2	43.6	248.2	43.8	249.2	43.9	250.1	44.1	251.1	44.3	252.1	44.5	253.1	44.5	254.1	44.5	255.1	44.5	32	
27	244.4	47.5	245.4	47.7	246.4	47.9	247.4	48.1	248.4	48.3	249.3	48.5	250.3	48.7	251.3	48.8	252.3	48.8	253.3	48.8	254.3	48.8	33	
28	243.6	51.8	244.5	52.0	245.5	52.2	246.5	52.4	247.5	52.6	248.4	52.8	249.4	53.0	250.4	53.2	251.4	53.2	252.4	53.2	253.4	53.2	34	
29	242.6	56.0	243.6	56.2	244.6	56.5	245.5	56.7	246.5	56.9	247.5	57.1	248.5	57.4	249.4	57.6	250.4	57.6	251.4	57.6	252.4	57.6	35	
30	241.6	60.2	242.6	60.5	243.5	60.7	244.5	61.0	245.5	61.2	246.5	61.4	247.4	61.7	248.4	61.9	249.4	61.9	250.4	61.9	251.4	61.9	36	
31	240.5	64.4	241.5	64.7	242.4	65.0	243.4	65.2	244.4	65.5	245.3	65.7	246.3	66.0	247.3	66.3	248.3	66.3	249.3	66.3	250.3	66.3	37	
32	239.4	68.6	240.3	68.9	241.3	69.2	242.2	69.5	243.2	69.7	244.2	70.0	245.1	70.3	246.1	70.6	247.1	70.6	248.1	70.6	249.1	70.6	38	
33	238.1	72.8	239.1	73.1	240.0	73.4	241.0	73.7	241.9	74.0	242.9	74.3	243.9	74.6	244.8	74.8	245.8	74.8	246.8	74.8	247.8	74.8	39	
34	236.8	76.9	237.8	77.3	238.7	77.6	239.7	77.9	240.6	78.2	241.6	78.5	242.5	78.8	243.5	79.1	244.5	79.1	245.5	79.1	246.5	79.1	40	
35	235.4	81.1	236.4	81.4	237.3	81.7	238.3	82.0	239.2	82.4	240.2	82.7	241.1	83.0	242.1	83.3	243.1	83.3	244.1	83.3	245.1	83.3	41	
36	234.0	85.2	234.9	85.5	235.9	85.8	236.8	86.2	237.7	86.5	238.7	86.9	239.6	87.2	240.6	87.6	241.5	87.6	242.5	87.6	243.5	87.6	42	
37	232.5	89.2	233.4	89.6	234.3	90.0	235.3	90.3	236.2	90.7	237.1	91.0	238.1	91.4	239.0	91.7	240.0	91.7	241.0	91.7	242.0	91.7	43	
38	230.9	93.3	231.8	93.7	232.7	94.0	233.7	94.4	234.6	94.8	235.5	95.2	236.4	95.5	237.4	95.9	238.3	95.9	239.3	95.9	240.3	95.9	44	
39	229.2	97.3	230.1	97.7	231.0	98.1	232.0	98.5	232.9	98.9	233.8	99.2	234.7	99.6	235.6	100.0	236.5	100.0	237.5	100.0	238.5	100.0	45	
40	227.5	101.3	228.4	101.7	229.3	102.1	230.2	102.5	231.1	102.9	232.0	103.3	233.0	103.7	233.9	104.1	234.8	104.1	235.8	104.1	236.8	104.1	46	
41	225.7	105.2	226.6	105.7	227.5	106.1	228.4	106.5	229.3	106.9	230.2	107.3	231.1	107.8	232.0	108.2	232.9	108.2	233.9	108.2	234.9	108.2	47	
42	223.8	109.2	224.7	109.6	225.6	110.0	226.5	110.5	227.4	110.9	228.3	111.3	229.2	111.8	230.1	112.2	231.0	112.2	232.0	112.2	233.0	112.2	48	
43	221.9	113.0	222.8	113.5	223.6	114.0	224.5	114.4	225.4	114.9	226.3	115.3	227.2	115.8	228.1	116.2	229.0	116.2	230.0	116.2	231.0	116.2	49	
44	219.9	116.9	220.7	117.4	221.6	117.8	222.5	118.3	223.4	118.8	224.3	119.2	225.2	119.7	226.0	120.2	227.0	120.2	228.0	120.2	229.0	120.2	50	
45	217.8	120.7	218.7	121.2	219.5	121.7	220.4	122.2	221.3	122.7	222.2	123.1	223.0	123.6	223.9	124.1	224.8	124.1	225.8	124.1	226.8	124.1	51	
46	215.6	124.5	216.5	125.0	217.4	125.5	218.2	126.0	219.1	126.5	220.0	127.0	220.8	127.5	221.4	128.0	222.0	128.0	223.0	128.0	224.0	128.0	52	
47	213.4	128.2	214.3	128.8	215.1	129.3	216.0																	

Traverse Table.

(x.)

Distance. 257			258			259			260			261			262			263			264		
Crs.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Diff.	Lat.	Dep.	Crs.	
1	256.7	12.6	257.7	12.7	258.7	12.7	259.7	12.8	260.7	12.8	261.7	12.9	262.7	12.9	263.7	13.0	264.7	13.0	265.7	13.1	266.7	13.2	
2	255.8	25.2	256.8	25.3	257.8	25.4	258.7	25.5	259.7	25.6	260.7	25.7	261.7	25.8	262.7	25.9	263.7	26.0	264.7	26.1	265.7	26.2	
3	254.2	37.7	255.2	37.9	256.2	38.0	257.2	38.1	258.2	38.3	259.2	38.4	260.1	38.6	261.1	38.7	262.1	38.8	263.1	38.9	264.1	39.0	
4	252.1	50.1	253.0	50.3	254.0	50.5	255.0	50.7	256.0	50.9	257.0	51.1	257.9	51.3	258.9	51.5	259.9	51.6	260.9	51.7	261.9	51.8	
5	249.3	62.5	250.3	62.7	251.2	62.9	252.2	63.2	253.2	63.4	254.2	63.7	255.1	63.9	256.1	64.2	257.1	64.3	258.1	64.4	259.1	64.5	
6	245.9	74.6	246.9	74.9	247.9	75.2	248.8	75.5	249.8	75.8	250.7	76.0	251.7	76.3	252.6	76.6	253.6	76.7	254.6	76.8	255.6	76.9	
7	242.0	86.6	242.9	86.9	243.9	87.2	244.8	87.6	245.7	87.9	246.7	88.3	247.6	88.6	248.6	88.9	249.6	89.0	250.6	89.1	251.6	89.2	
8	237.4	98.4	238.4	98.7	239.3	99.1	240.2	99.5	241.1	99.9	242.1	100.3	243.0	100.6	243.9	101.0	244.9	101.1	245.9	101.2	246.9	101.3	
9	232.3	109.9	233.2	110.3	234.1	110.7	235.0	111.2	235.9	111.6	236.8	112.0	237.7	112.5	238.7	112.9	239.6	113.0	240.6	113.1	241.6	113.2	
10	226.7	121.1	227.5	121.6	228.4	122.1	229.3	122.6	230.2	123.0	231.1	123.5	232.1	124.0	233.8	124.4	234.9	124.5	235.9	124.6	236.9	124.7	
11	220.4	132.1	221.3	132.6	222.1	133.1	223.0	133.7	223.9	134.2	224.7	134.7	225.6	135.2	226.4	135.7	227.9	135.8	228.9	135.9	229.9	136.0	
12	213.7	142.8	214.5	143.3	215.3	143.9	216.2	144.4	217.0	145.0	217.8	145.6	218.7	146.1	219.5	146.7	220.9	146.8	221.9	146.9	222.9	147.0	
13	206.4	153.1	207.2	153.7	208.0	154.3	208.8	154.9	209.6	155.5	210.4	156.1	211.2	156.7	212.0	157.3	213.9	156.8	214.9	156.9	215.9	157.0	
14	198.7	163.0	199.4	163.7	200.2	164.3	201.0	164.9	201.8	165.6	202.5	166.2	203.3	166.8	204.1	167.5	205.9	166.9	207.9	167.0	208.9	167.1	
15	190.4	172.6	191.2	173.2	191.9	173.9	192.6	174.6	193.4	175.3	194.1	175.9	194.9	176.6	195.6	177.3	201.9	176.7	202.9	176.8	203.9	176.9	
16	181.7	181.7	182.4	182.4	183.1	183.1	183.8	183.8	184.6	184.6	185.3	185.3	186.0	186.0	186.7	186.7	187.4	186.1	187.1	186.2	186.3		
17	175.0	04.5	175.0	04.5	175.0	04.5	175.0	04.5	175.0	04.6	175.0	04.6	175.0	04.6	175.0	04.6	175.0	04.6	175.0	04.6	175.0	04.6	
18	256.8	19.0	257.8	19.0	258.8	19.0	259.8	19.1	260.8	19.1	261.8	19.1	262.8	19.2	263.8	19.2	264.8	19.2	265.8	19.2	266.8	19.2	
19	256.6	35.5	257.6	35.5	258.6	35.6	259.6	35.6	260.6	35.7	261.6	35.7	262.6	35.7	263.6	35.8	264.6	35.8	265.6	35.8	266.6	35.8	
20	256.4	17.9	257.4	18.0	258.4	18.1	259.4	18.1	260.4	18.2	261.4	18.3	262.4	18.3	263.4	18.4	264.4	18.3	265.4	18.4	266.4	18.4	
21	255.6	22.4	256.6	22.5	257.6	22.6	258.6	22.7	259.6	22.7	260.6	22.8	261.6	22.8	262.6	22.9	263.6	22.9	264.6	22.9	265.6	23.0	
22	255.0	26.9	256.0	27.0	257.0	27.1	258.0	27.2	259.0	27.2	260.0	27.3	261.0	27.3	262.0	27.4	263.0	27.4	264.0	27.4	265.0	27.5	
23	255.1	31.3	256.1	31.4	257.1	31.6	258.1	31.7	259.1	31.8	260.0	31.9	261.0	32.1	262.0	32.2	263.0	32.1	264.0	32.2	265.0	32.2	
24	254.5	35.8	255.5	35.9	256.5	36.0	257.5	36.2	258.5	36.3	259.5	36.5	260.4	36.6	261.4	36.7	262.4	36.6	263.4	36.7	264.4	36.7	
25	253.8	40.2	254.8	40.4	255.8	40.5	256.8	40.7	257.8	40.8	258.8	41.0	259.8	41.1	260.7	41.3	261.7	41.2	262.7	41.3	263.7	41.3	
26	253.1	44.6	254.1	44.8	255.1	45.0	256.1	45.1	257.0	45.3	258.0	45.5	259.0	45.7	260.0	45.8	261.0	45.8	262.0	45.9	263.0	45.9	
27	252.3	49.0	253.3	49.2	254.2	49.4	255.2	49.6	256.2	49.8	257.2	50.0	258.2	50.2	259.1	50.4	260.1	50.3	261.1	50.4	262.1	50.4	
28	251.4	53.4	252.4	53.6	253.3	53.8	254.3	54.1	255.3	54.3	256.3	54.5	257.3	54.7	258.2	54.9	259.2	54.8	260.2	54.9	261.2	54.9	
29	250.4	57.8	251.4	58.0	252.4	58.3	253.3	58.5	254.3	58.7	255.3	58.9	256.3	59.1	257.2	59.4	258.2	59.3	259.2	59.4	260.2	59.4	
30	249.4	62.2	250.3	62.4	251.3	62.7	252.3	62.9	253.2	63.1	254.2	63.4	255.2	63.6	256.2	63.9	257.2	63.8	258.2	63.9	259.2	63.9	
31	248.2	66.5	249.2	66.8	250.2	67.0	251.1	67.3	252.1	67.6	253.1	67.8	254.0	68.1	255.0	68.3	256.0	68.3	257.0	68.4	258.0	68.4	
32	247.0	70.8	248.0	71.1	249.0	71.4	249.9	71.7	250.9	71.9	251.9	72.2	252.8	72.5	253.8	72.8	254.8	72.8	255.8	72.9	256.8	72.9	
33	245.8	75.1	246.7	75.4	247.7	75.7	248.6	76.0	249.6	76.3	250.6	76.6	251.5	76.9	252.5	77.2	253.5	77.2	254.5	77.3	255.5	77.3	
34	244.4	79.4	245.4	79.7	246.3	80.0	247.3	80.3	248.2	80.7	249.2	81.0	250.1	81.3	251.1	81.6	252.1	81.6	253.1	81.7	254.1	81.7	
35	243.0	83.7	243.9	84.0	244.9	84.3	245.8	84.6	246.8	85.0	247.7	85.3	248.7	85.6	249.6	86.0	250.6	85.9	251.6	86.0	252.6	86.1	
36	241.5	87.9	242.4	88.2	243.4	88.6	244.3	88.9	245.3	89.3	246.2	89.6	247.1	90.0	248.1	90.3	249.1	90.3	250.1	90.4	251.1	90.4	
37	239.9	92.1	240.9	92.5	241.8	92.8	242.7	93.2	243.7	93.5	244.6	93.9	245.5	94.3	246.5	94.6	247.5	94.6	248.5	94.7	249.5	94.7	
38	238.3	96.3	239.2	96.6	240.1	97.0	241.1	97.4	242.0	97.8	242.9	98.1	243.8	98.5	244.8	98.9	245.8	98.9	246.8	99.0	247.8	99.0	
39	236.6	100.4	237.5	100.8	238.4	101.2	239.3	101.6	240.3	102.0	241.2	102.4	242.1	102.8	243.0	103.2	243.9	103.2	244.9	103.3	245.9	103.4	
40	234.8	104.5	235.7	104.9	236.6	105.3	237.5	105.8	238.4	106.2	239.3	106.6	240.3	107.0	241.2	107.4	242.1	107.4	243.1	107.5	244.1	107.5	
41	232.9	108.6	233.8	109.0	234.7	109.5	235.6	109.9	236.5	110.3	237.5	110.7	238.4	111.1	239.3	111.6	240.2	111.6	241.2	111.7	242.2	111.8	
42	231.0	112.7	231.9	113.1	232.8	113.5	233.7	114.0	234.6	114.4	235.5	114.9	236.4	115.3	237.3	115.7	238.2	115.7	239.2	115.8	240.2	115.9	
43	229.0	116.7	229.9	117.1	230.8	117.6	231.7	118.0	232.6	118.5	233.4	118.9	234.3	119.4	235.2	119.9	236.1	119.9	237.1	120.0	238.1	120.0	
44	226.9	120.7	227.8	121.1	228.7	121.6	229.6	122.1	230.4	122.5	233.1	123.0	232.2	123.5	233.1	123.9	234.1	123.9	235.1	124.0	236.1	124.0	
45	224.8	124.6	225.7	125.1	226.5	125.6	227.4	126.1	228.3	126.5	229.2	127.0	230.0	127.5	230.9	128.0	231.9	128.0	232.9	128.1	233.9	128.1	
46	222.6	128.5	223.4	129.0	224.3	129.5	225.2	130.0	226.0	130.5	226.9	131.0	227.8	131.5	228.6	132.0	229.6	132.0	230.6	132.1	231.6	132.1	
47	220.3	132.4	221.1	132.9	222.0	133.4	222.9	133.9	223.7	134.4	224.6	134.9	225.4	135.5	226.3	136.0	227.9	136.0	228.9	136.1	229.9	136.1	
48	217.9	136.2	218.8	136.7	219.6	137.2	220.5	137.8	221.3	138.3	222.2	138.8	223.0	139.4	223.9	139.9	224.9	139.9	225.9	140.0	226.9	140.0	
49	215.5	140.0	216.4	140.5	2																		

Traverse Table.

(x.)

Distance. 265			266			267			268			269			270			271			272			
Crse.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crse.	
1	264.7	13.0	265.7	13.1	266.7	13.1	267.7	13.2	268.7	13.2	269.7	13.3	270.7	13.3	271.7	13.3	272.0	13.3	272.0	13.3	272.0	13.3	73	
2	263.7	26.0	264.7	26.1	265.7	26.2	266.7	26.3	267.7	26.4	268.7	26.5	269.7	26.6	270.7	26.7	271.0	26.7	271.0	26.7	271.0	26.7	74	
3	262.1	38.9	263.1	39.0	264.1	39.2	265.1	39.3	266.1	39.5	267.1	39.6	268.1	39.8	269.0	39.9	270.0	39.9	270.0	39.9	270.0	39.9	75	
4	259.9	51.7	260.9	51.9	261.9	52.1	262.8	52.3	263.8	52.5	264.8	52.7	265.8	52.9	266.8	53.1	267.0	53.1	267.0	53.1	267.0	53.1	76	
5	257.1	64.4	258.0	64.6	259.0	64.9	260.0	65.1	260.9	65.4	261.9	65.6	262.9	65.9	263.9	66.1	264.0	66.1	264.0	66.1	264.0	66.1	77	
6	253.6	76.9	254.6	77.2	255.5	77.5	256.5	77.8	257.4	78.1	258.4	78.4	259.3	78.7	260.3	79.0	260.4	79.0	260.4	79.0	260.4	79.0	78	
7	249.5	89.3	250.4	89.6	251.4	89.9	252.3	90.3	253.3	90.6	254.2	91.0	255.2	91.3	256.1	91.6	256.2	91.6	256.2	91.6	256.2	91.6	79	
8	244.8	101.4	245.8	101.8	246.7	102.2	247.6	102.6	248.5	102.9	249.5	103.3	250.4	103.7	251.3	104.1	251.4	104.1	251.4	104.1	251.4	104.1	80	
9	239.6	113.3	240.5	113.7	241.4	114.2	242.3	114.6	243.2	115.0	244.1	115.4	245.0	115.9	245.9	116.3	246.0	116.3	246.0	116.3	246.0	116.3	81	
10	233.7	124.9	234.6	125.4	235.5	125.9	236.4	126.3	237.2	126.8	238.1	127.3	239.0	127.7	239.9	128.2	240.0	128.2	240.0	128.2	240.0	128.2	82	
11	227.3	136.2	228.2	136.7	229.0	137.3	229.9	137.8	230.7	138.3	231.6	138.8	232.4	139.3	233.3	139.8	233.4	139.8	233.4	139.8	233.4	139.8	83	
12	220.3	147.2	221.2	147.8	222.0	148.3	222.8	148.9	223.7	149.4	224.5	150.0	225.3	150.6	226.2	151.1	226.3	151.1	226.3	151.1	226.3	151.1	84	
13	212.8	157.9	213.6	158.5	214.5	159.1	215.3	159.6	216.1	160.2	216.9	160.8	217.7	161.4	218.5	162.0	217.7	162.0	217.7	162.0	217.7	162.0	85	
14	204.8	168.1	205.6	168.7	206.4	169.4	207.2	170.0	207.9	170.6	208.7	171.3	209.5	171.9	210.3	172.6	209.5	172.6	209.5	172.6	209.5	172.6	86	
15	196.3	178.0	197.1	178.6	197.8	179.3	198.6	180.0	199.3	180.6	200.1	181.3	200.8	182.0	201.5	182.7	200.8	182.7	200.8	182.7	200.8	182.7	87	
16	187.4	187.4	188.1	188.1	188.8	188.8	189.5	189.5	190.2	190.2	190.9	190.9	191.6	191.6	192.3	192.3	190.9	192.3	190.9	192.3	190.9	192.3	88	
17	265.0	04.6	266.0	04.6	267.0	04.7	268.0	04.7	269.0	04.7	270.0	04.7	271.0	04.7	272.0	04.7	272.0	04.7	272.0	04.7	272.0	04.7	89	
18	264.8	09.2	265.8	09.3	266.8	09.3	267.8	09.4	268.8	09.4	269.8	09.4	270.8	09.5	271.8	09.5	271.8	09.5	271.8	09.5	271.8	09.5	90	
19	264.6	13.9	265.6	13.9	266.6	14.0	267.6	14.0	268.6	14.1	269.6	14.1	270.6	14.2	271.6	14.2	271.6	14.2	271.6	14.2	271.6	14.2	91	
20	264.4	18.5	265.4	18.6	266.3	18.6	267.3	18.7	268.3	18.8	269.3	18.8	270.3	18.9	271.3	18.9	271.3	18.9	271.3	18.9	271.3	18.9	92	
21	264.0	23.1	265.0	23.2	266.0	23.3	267.0	23.4	268.0	23.4	269.0	23.5	270.0	23.6	271.0	23.7	271.0	23.7	271.0	23.7	271.0	23.7	93	
22	263.5	27.7	264.5	27.8	265.5	27.9	266.5	28.0	267.5	28.1	268.5	28.2	269.5	28.3	270.5	28.4	270.5	28.4	270.5	28.4	270.5	28.4	94	
23	263.0	32.3	264.0	32.4	265.0	32.5	266.0	32.7	267.0	32.8	268.0	32.9	269.0	33.0	270.0	33.1	270.0	33.1	270.0	33.1	270.0	33.1	95	
24	262.4	36.9	263.4	37.0	264.4	37.2	265.4	37.3	266.4	37.4	267.4	37.6	268.4	37.7	269.4	37.9	269.4	37.9	269.4	37.9	269.4	37.9	96	
25	261.7	41.5	262.7	41.6	263.7	41.8	264.7	41.9	265.7	42.1	266.7	42.2	267.7	42.4	268.7	42.6	268.7	42.6	268.7	42.6	268.7	42.6	97	
26	261.0	46.0	262.0	46.2	262.9	46.4	263.9	46.5	264.9	46.7	265.9	46.9	266.9	47.1	267.9	47.2	267.9	47.2	267.9	47.2	267.9	47.2	98	
27	260.1	50.6	261.1	50.8	262.1	50.9	263.1	51.1	264.1	51.3	265.0	51.5	266.0	51.7	267.0	51.9	267.0	51.9	267.0	51.9	267.0	51.9	99	
28	259.2	55.1	260.2	55.3	261.2	55.5	262.1	55.7	263.1	55.9	264.1	56.1	265.1	56.3	266.1	56.6	266.1	56.6	266.1	56.6	266.1	56.6	100	
29	258.2	59.6	259.2	59.8	260.2	60.1	261.1	60.3	262.1	60.5	263.1	60.7	264.1	61.0	265.0	61.2	265.0	61.2	265.0	61.2	265.0	61.2	101	
30	257.1	64.1	258.1	64.4	259.1	64.6	260.0	64.8	261.0	65.1	262.0	65.3	263.0	65.6	263.9	65.8	263.9	65.8	263.9	65.8	263.9	65.8	102	
31	256.0	68.6	256.9	68.8	257.9	69.1	258.9	69.4	259.8	69.6	260.8	69.9	261.8	70.1	262.7	70.4	262.7	70.4	262.7	70.4	262.7	70.4	103	
32	254.7	73.0	255.7	73.3	256.7	73.6	257.6	73.9	258.6	74.1	259.5	74.4	260.5	74.7	261.5	75.0	261.5	75.0	261.5	75.0	261.5	75.0	104	
33	253.4	77.5	254.4	77.8	255.3	78.1	256.3	78.4	257.2	78.6	258.2	78.9	259.2	79.2	260.1	79.5	260.1	79.5	260.1	79.5	260.1	79.5	105	
34	252.0	81.9	253.0	82.2	253.9	82.5	254.9	82.8	255.8	83.1	256.8	83.4	257.7	83.7	258.7	84.1	258.7	84.1	258.7	84.1	258.7	84.1	106	
35	250.6	86.3	251.5	86.6	252.5	86.9	253.4	87.3	254.3	87.6	255.3	87.9	256.2	88.2	257.2	88.6	257.2	88.6	257.2	88.6	257.2	88.6	107	
36	249.0	90.6	250.0	91.0	250.9	91.3	251.8	91.7	252.8	92.0	253.7	92.3	254.7	92.7	255.6	93.0	255.6	93.0	255.6	93.0	255.6	93.0	108	
37	247.4	95.0	248.3	95.3	249.3	95.7	250.2	96.0	251.1	96.4	252.1	96.8	253.0	97.1	253.9	97.5	253.9	97.5	253.9	97.5	253.9	97.5	109	
38	245.7	99.3	246.6	99.6	247.6	100.0	248.5	100.4	249.4	100.8	250.3	101.1	251.3	101.5	252.2	101.9	252.2	101.9	252.2	101.9	252.2	101.9	110	
39	243.9	103.5	244.9	103.9	245.8	104.3	246.7	104.7	247.6	105.1	248.5	105.5	249.5	105.9	250.4	106.3	249.5	106.3	249.5	106.3	249.5	106.3	111	
40	242.1	107.8	243.0	108.2	243.9	108.6	244.8	109.0	245.7	109.4	246.7	109.8	247.6	110.2	248.5	110.6	247.6	110.6	247.6	110.6	247.6	110.6	112	
41	240.2	112.0	241.1	112.4	242.0	112.8	242.9	113.3	243.8	113.7	244.7	114.1	245.6	114.5	246.5	115.0	245.6	115.0	245.6	115.0	245.6	115.0	113	
42	238.2	116.2	239.1	116.6	240.0	117.0	240.9	117.5	241.8	117.9	242.7	118.4	243.6	118.8	244.5	119.2	243.6	119.2	243.6	119.2	243.6	119.2	114	
43	236.1	120.3	237.0	120.8	237.9	121.2	238.8	121.7	239.7	122.1	240.6	122.6	241.5	123.0	242.4	123.5	241.5	123.5	241.5	123.5	241.5	123.5	115	
44	234.0	124.4	234.9	124.9	235.7	125.3	236.6	125.8	237.5	126.3	238.4	126.8	239.3	127.2	240.2	127.7	239.3	127.7	239.3	127.7	239.3	127.7	116	
45	231.8	128.5	232.6	129.0	233.5	129.4	234.4	129.9	235.3	130.4	236.1	130.9	237.0	131.4	237.9	131.9	237.0	131.9	237.0	131.9	237.0	131.9	117	
46	229.5	132.5	230.4	133.0	231.2	133.5	232.1	134.0	233.0	134.5	233.8	135.0	234.7	135.5	235.6	136.0	234.7	136.0	234.7	136.0	234.7	136.0	118	
47	227.1	136.5	228.0	137.0	228.9	137.5	229.7	138.0	230.0	138.5	231.4	139												

Traverse Table.

(x)

Distance. 273			274			275			276			277			278			279			280		
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Crs.		
1 1																							

Traverse Table.

(x)

Distance. 281		282		283		284		285		286		287		288		Crs.
Crs.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	Diff. Lat. | Dep.	
1	280.7 13.8	281.7 13.8	282.7 13.9	283.7 13.9	284.7 14.0	285.7 14.0	286.7 14.1	287.7 14.1	288.7 14.1	289.7 14.1	290.7 14.1	291.7 14.1	292.7 14.1	293.7 14.1	294.7 14.1	7 1/2
2	279.6 27.5	280.6 27.6	281.6 27.7	282.6 27.8	283.6 27.8	284.6 27.9	285.6 28.0	286.6 28.1	287.6 28.1	288.6 28.2	289.6 28.2	290.6 28.2	291.6 28.2	292.6 28.2	293.6 28.2	8 1/2
3	278.0 41.2	278.9 41.4	279.9 41.5	280.9 41.7	281.9 41.8	282.9 42.0	283.9 42.1	284.9 42.2	285.9 42.3	286.9 42.3	287.9 42.4	288.9 42.4	289.9 42.4	290.9 42.4	291.9 42.4	9 1/2
4	275.6 54.8	276.6 55.0	277.6 55.2	278.5 55.4	279.5 55.6	280.5 55.8	281.5 56.0	282.5 56.2	283.5 56.2	284.5 56.3	285.5 56.4	286.5 56.4	287.5 56.4	288.5 56.4	289.5 56.4	10 1/2
5	272.6 68.3	273.6 68.5	274.5 68.8	275.5 69.0	276.5 69.3	277.4 69.5	278.4 69.7	279.4 70.0	280.4 70.0	281.4 70.1	282.4 70.1	283.4 70.1	284.4 70.1	285.4 70.1	286.4 70.1	11 1/2
6	268.9 81.6	269.9 81.9	270.8 82.1	271.8 82.4	272.7 82.7	273.7 83.0	274.6 83.3	275.6 83.6	276.6 83.6	277.6 83.7	278.6 83.7	279.6 83.7	280.6 83.7	281.6 83.7	282.6 83.7	12 1/2
7	264.6 94.7	265.5 95.0	266.5 95.3	267.4 95.7	268.3 96.0	269.3 96.3	270.2 96.7	271.2 97.0	272.2 97.0	273.2 97.1	274.2 97.1	275.2 97.1	276.2 97.1	277.2 97.1	278.2 97.1	13 1/2
8	259.6 107.5	260.5 107.9	261.5 108.3	262.4 108.7	263.3 109.1	264.2 109.5	265.2 109.8	266.1 110.2	267.1 110.2	268.1 110.2	269.1 110.2	270.1 110.2	271.1 110.2	272.1 110.2	273.1 110.2	14 1/2
9	254.0 120.2	254.9 120.6	255.8 121.0	256.7 121.4	257.6 121.9	258.5 122.3	259.4 122.7	260.3 123.1	261.3 123.1	262.3 123.1	263.3 123.1	264.3 123.1	265.3 123.1	266.3 123.1	267.3 123.1	15 1/2
10	247.8 132.5	248.7 132.9	249.6 133.4	250.5 133.9	251.4 134.3	252.3 134.8	253.2 135.3	254.0 135.8	255.0 135.8	256.0 135.8	257.0 135.8	258.0 135.8	259.0 135.8	260.0 135.8	261.0 135.8	16 1/2
11	241.0 144.5	241.9 145.0	242.7 145.5	243.6 146.0	244.4 146.5	245.3 147.0	246.2 147.5	247.0 148.1	248.0 148.1	249.0 148.1	250.0 148.1	251.0 148.1	252.0 148.1	253.0 148.1	254.0 148.1	17 1/2
12	233.6 156.1	234.5 156.7	235.3 157.2	236.1 157.8	237.0 158.3	237.8 158.9	238.6 159.4	239.5 160.0	240.5 160.0	241.5 160.0	242.5 160.0	243.5 160.0	244.5 160.0	245.5 160.0	246.5 160.0	18 1/2
13	225.7 167.4	226.5 168.0	227.3 168.6	228.1 169.2	229.0 169.8	229.7 170.4	230.5 171.0	231.3 171.6	232.3 171.6	233.3 171.6	234.3 171.6	235.3 171.6	236.3 171.6	237.3 171.6	238.3 171.6	19 1/2
14	217.2 178.3	218.0 178.9	218.8 179.5	219.5 180.2	220.3 180.8	221.1 181.4	221.8 182.1	222.6 182.7	223.6 182.7	224.6 182.7	225.6 182.7	226.6 182.7	227.6 182.7	228.6 182.7	229.6 182.7	20 1/2
15	208.2 188.7	209.5 189.4	210.7 190.0	211.9 190.7	213.1 191.4	214.3 192.1	215.5 192.8	216.7 193.4	218.0 193.4	219.3 193.4	220.6 193.4	221.9 193.4	223.2 193.4	224.5 193.4	225.8 193.4	21 1/2
16	198.7 198.7	199.4 199.4	200.1 200.1	200.8 200.8	201.5 201.5	202.2 202.2	202.9 202.9	203.6 203.6	204.3 203.6	205.0 203.6	205.7 203.6	206.4 203.6	207.1 203.6	207.8 203.6	208.5 203.6	22 1/2
17	281.0 04.9	282.0 04.9	283.0 04.9	284.0 05.0	285.0 05.0	286.0 05.0	287.0 05.0	288.0 05.0	289.0 05.0	290.0 05.0	291.0 05.0	292.0 05.0	293.0 05.0	294.0 05.0	295.0 05.0	89 1/2
18	280.8 09.8	281.8 09.8	282.8 09.9	283.8 09.9	284.8 09.9	285.8 10.0	286.8 10.0	287.8 10.1	288.8 10.1	289.8 10.1	290.8 10.1	291.8 10.1	292.8 10.1	293.8 10.1	294.8 10.1	90 1/2
19	280.6 14.7	281.6 14.8	282.6 14.8	283.6 14.9	284.6 14.9	285.6 15.0	286.6 15.0	287.6 15.1	288.6 15.1	289.6 15.1	290.6 15.1	291.6 15.1	292.6 15.1	293.6 15.1	294.6 15.1	91 1/2
20	280.2 19.6	281.3 19.7	282.3 19.7	283.3 19.8	284.3 19.8	285.3 20.0	286.3 20.0	287.3 20.1	288.3 20.1	289.3 20.1	290.3 20.1	291.3 20.1	292.3 20.1	293.3 20.1	294.3 20.1	92 1/2
21	279.9 24.5	280.9 24.6	281.9 24.7	282.9 24.8	283.9 24.8	284.9 24.9	285.9 25.0	286.9 25.1	287.9 25.1	288.9 25.1	289.9 25.1	290.9 25.1	291.9 25.1	292.9 25.1	293.9 25.1	93 1/2
22	279.5 29.4	280.5 29.5	281.5 29.6	282.4 29.7	283.4 29.8	284.4 29.9	285.4 30.0	286.4 30.1	287.4 30.1	288.4 30.1	289.4 30.1	290.4 30.1	291.4 30.1	292.4 30.1	293.4 30.1	94 1/2
23	278.9 34.2	279.9 34.4	280.9 34.5	281.9 34.6	282.9 34.7	283.9 34.9	284.9 35.0	285.9 35.1	286.9 35.1	287.9 35.1	288.9 35.1	289.9 35.1	290.9 35.1	291.9 35.1	292.9 35.1	95 1/2
24	278.3 39.1	279.3 39.2	280.2 39.4	281.2 39.5	282.2 39.7	283.2 39.8	284.2 39.9	285.2 40.1	286.2 40.1	287.2 40.1	288.2 40.1	289.2 40.1	290.2 40.1	291.2 40.1	292.2 40.1	96 1/2
25	277.5 44.0	278.5 44.1	279.5 44.3	280.5 44.4	281.5 44.6	282.5 44.7	283.5 44.9	284.5 45.1	285.5 45.1	286.5 45.1	287.5 45.1	288.5 45.1	289.5 45.1	290.5 45.1	291.5 45.1	97 1/2
26	276.7 48.8	277.7 49.0	278.7 49.1	279.7 49.3	280.7 49.5	281.7 49.7	282.6 49.8	283.6 50.0	284.6 50.0	285.6 50.0	286.6 50.0	287.6 50.0	288.6 50.0	289.6 50.0	290.6 50.0	98 1/2
27	275.8 53.6	276.8 53.8	277.8 54.0	278.8 54.2	279.8 54.4	280.7 54.6	281.7 54.8	282.7 55.0	283.7 55.0	284.7 55.0	285.7 55.0	286.7 55.0	287.7 55.0	288.7 55.0	289.7 55.0	99 1/2
28	274.9 58.4	275.8 58.6	276.8 58.8	277.8 59.0	278.8 59.3	279.8 59.5	280.7 59.7	281.7 59.9	282.7 59.9	283.7 59.9	284.7 59.9	285.7 59.9	286.7 59.9	287.7 59.9	288.7 59.9	100 1/2
29	273.8 63.2	274.8 63.4	275.7 63.7	276.7 63.9	277.7 64.1	278.7 64.3	279.6 64.6	280.6 64.8	281.6 64.8	282.6 64.8	283.6 64.8	284.6 64.8	285.6 64.8	286.6 64.8	287.6 64.8	101 1/2
30	272.7 68.0	273.6 68.2	274.6 68.5	275.6 68.7	276.6 68.9	277.5 69.2	278.5 69.4	279.4 69.7	280.4 69.7	281.4 69.7	282.4 69.7	283.4 69.7	284.4 69.7	285.4 69.7	286.4 69.7	102 1/2
31	271.4 72.7	272.4 73.0	273.4 73.2	274.3 73.5	275.3 73.8	276.3 74.0	277.2 74.3	278.2 74.5	279.2 74.5	280.2 74.5	281.2 74.5	282.2 74.5	283.2 74.5	284.2 74.5	285.2 74.5	103 1/2
32	270.1 77.5	271.1 77.7	272.0 78.0	273.0 78.2	274.0 78.5	275.0 78.8	276.0 79.1	277.0 79.4	278.0 79.4	279.0 79.4	280.0 79.4	281.0 79.4	282.0 79.4	283.0 79.4	284.0 79.4	104 1/2
33	268.7 82.2	269.7 82.4	270.6 82.7	271.6 83.0	272.5 83.3	273.5 83.6	274.5 83.9	275.4 84.2	276.4 84.2	277.4 84.2	278.4 84.2	279.4 84.2	280.4 84.2	281.4 84.2	282.4 84.2	105 1/2
34	267.2 86.8	268.2 87.1	269.1 87.5	270.1 87.8	271.1 88.1	272.0 88.4	273.0 88.7	274.0 89.0	275.0 89.0	276.0 89.0	277.0 89.0	278.0 89.0	279.0 89.0	280.0 89.0	281.0 89.0	106 1/2
35	265.7 91.5	266.6 91.8	267.6 92.1	268.5 92.5	269.5 92.8	270.4 93.1	271.4 93.4	272.3 93.8	273.3 93.8	274.3 93.8	275.3 93.8	276.3 93.8	277.3 93.8	278.3 93.8	279.3 93.8	107 1/2
36	264.1 96.1	265.0 96.4	265.9 96.8	266.9 97.1	267.8 97.5	268.8 97.8	269.7 98.2	270.6 98.5	271.6 98.5	272.6 98.5	273.6 98.5	274.6 98.5	275.6 98.5	276.6 98.5	277.6 98.5	108 1/2
37	262.3 100.7	263.3 101.1	264.2 101.4	265.1 101.8	266.1 102.1	267.0 102.5	267.9 102.9	268.9 103.2	269.9 103.2	270.9 103.2	271.9 103.2	272.9 103.2	273.9 103.2	274.9 103.2	275.9 103.2	109 1/2
38	260.5 105.3	261.5 105.6	262.4 106.0	263.3 106.4	264.2 106.8	265.2 107.1	266.1 107.5	267.0 107.9	268.0 107.9	269.0 107.9	270.0 107.9	271.0 107.9	272.0 107.9	273.0 107.9	274.0 107.9	110 1/2
39	258.7 109.8	259.7 110.2	260.5 110.6	261.4 111.0	262.3 111.4	263.3 111.7	264.2 112.1	265.2 112.5	266.2 112.5	267.2 112.5	268.2 112.5	269.2 112.5	270.2 112.5	271.2 112.5	272.2 112.5	111 1/2
40	256.7 114.3	257.6 114.7	258.5 115.1	259.4 115.5	260.4 115.9	261.3 116.3	262.2 116.7	263.1 117.1	264.1 117.1	265.1 117.1	266.1 117.1	267.1 117.1	268.1 117.1	269.1 117.1	270.1 117.1	112 1/2
41	254.7 118.8	255.6 119.2	256.5 119.6	257.4 120.0	258.3 120.4	259.2 120.9	260.1 121.3	261.0 121.7	262.0 121.7	263.0 121.7	264.0 121.7	265.0 121.7	266.0 121.7	267.0 121.7	268.0 121.7	113 1/2
42	252.6 123.2	253.5 123.6	254.4 124.1	255.3 124.5	256.2 124.9	257.1 125.4	258.0 125.8	258.9 126.3	259.9 126.3	260.9 126.3	261.9 126.3	262.9 126.3	263.9 126.3	264.9 126.3	265.9 126.3	114 1/2
43	250.4 127.6	251.3 128.0	252.2 128.5	253.0 128.9	253.9 129.4	254.8 129.8	255.7 130.3	256.6 130.7	257.6 130.7	258.6 130.7	259.6 130.7	260.6 130.7	261.6 130.7	262.6 130.7	263.6 130.7	115 1/2
44	248.1 131.9	249.0 132.4	249.9 132.9	250.8 133.3	251.6 133.8	252.5 134.3	253.4 134.7	254.3 135.2	255.3 135.2	256.3 135.2	257.3 135.2	258.3 135.2	259.3 135.2	260.3 135.2	261.3 135.2	116 1/2
45	245.8 136.2	246.6 136.7	247.5 137.2	248.4 137.7	249.3 138.2	250.1 138.7	251.0 139.1	251.9 139.6	252.9 139.6	253.9 139.6	254.9 139.6	255.9 139.6	256.9 139.6	257.9 139.6	258.9 139.6	117 1/2
46	243.4 140.5	244.2 141.0	245.1 141.5	246.0 142.0	246.8 142.5	247.7 143.0	248.5 143.5	249.4 144.0	250.4 144.0	251.4 144.0	252.4 144.0	253.4 144.0	254.4 144.0	255.4 144.0	256.4 144.0	118 1/2
47	240.9 144.7	241.7 145.2	242.6 145.8	243.4 146.3	244.3 146.8	245										

Distance 289			290		291		292		293		294		295		296		Crs. Pts.
Crs.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	
1	288.7	14.2	289.7	14.2	290.7	14.3	291.7	14.3	292.7	14.4	293.6	14.4	294.6	14.5	295.6	14.5	7
	287.6	28.3	288.6	28.4	289.6	28.5	290.6	28.6	291.6	28.7	292.6	28.8	293.6	28.9	294.6	29.0	7
	285.9	42.4	286.9	42.5	287.8	42.7	288.8	42.8	289.8	43.0	290.8	43.1	291.8	43.3	292.8	43.4	7
	283.4	56.4	284.4	56.6	285.4	56.8	286.4	57.0	287.4	57.2	288.3	57.4	289.3	57.6	290.3	57.7	7
	280.3	70.2	281.3	70.5	282.3	70.7	283.3	71.0	284.2	71.2	285.2	71.4	286.2	71.7	287.1	71.9	7
2	276.6	83.9	277.5	84.2	278.5	84.5	279.4	84.8	280.4	85.0	281.3	85.3	282.3	85.6	283.3	85.9	7
	272.1	97.4	273.0	97.7	274.0	98.0	274.9	98.4	275.9	98.7	276.8	99.0	277.7	99.4	278.7	99.7	7
	267.0	110.6	267.9	111.0	268.9	111.4	269.8	111.7	270.7	112.1	271.6	112.5	272.5	112.9	273.5	113.3	6
	261.3	123.6	262.2	124.0	263.1	124.4	264.0	124.9	264.9	125.3	265.8	125.7	266.7	126.1	267.6	126.6	6
	254.9	136.2	255.8	136.7	256.6	137.2	257.5	137.6	258.4	138.1	259.3	138.6	260.2	139.1	261.1	139.5	6
3	247.9	148.6	248.7	149.1	249.6	149.6	250.5	150.1	251.3	150.6	252.2	151.1	253.0	151.7	253.9	152.2	6
	240.3	160.6	241.1	161.1	242.0	161.7	242.8	162.2	243.6	162.8	244.4	163.3	245.3	163.9	246.1	164.4	5
	232.1	172.2	232.9	172.8	233.7	173.3	234.5	173.9	235.3	174.5	236.1	175.1	236.9	175.7	237.7	176.3	5
	223.4	183.3	224.2	184.0	224.9	184.6	225.7	185.2	226.5	185.9	227.3	186.5	228.0	187.1	228.8	187.8	5
	214.1	194.1	214.9	194.7	215.6	195.4	216.4	196.1	217.1	196.8	217.8	197.4	218.6	198.1	219.3	198.8	5
4	204.3	204.3	205.1	205.1	205.8	205.8	206.5	206.5	207.2	207.2	207.9	207.9	208.6	208.6	209.3	209.3	4
1"	289.0	05.0	290.0	05.1	291.0	05.1	292.0	05.1	293.0	05.1	294.0	05.1	295.0	05.1	296.0	05.2	89
	288.0	10.1	289.8	10.1	290.8	10.2	291.8	10.2	292.8	10.2	293.8	10.3	294.8	10.3	295.8	10.3	88
	288.6	15.1	289.6	15.2	290.6	15.2	291.6	15.3	292.6	15.3	293.6	15.4	294.6	15.4	295.6	15.5	87
	288.3	20.2	289.3	20.2	290.3	20.3	291.3	20.4	292.3	20.4	293.3	20.5	294.3	20.6	295.3	20.6	86
	287.9	25.2	288.9	25.3	289.9	25.4	290.9	25.4	291.9	25.5	292.9	25.6	293.9	25.7	294.9	25.8	85
2	287.4	30.2	288.4	30.3	289.4	30.4	290.4	30.5	291.4	30.6	292.4	30.7	293.4	30.8	294.4	30.9	84
	286.8	35.2	287.8	35.3	288.8	35.5	289.8	35.6	290.8	35.7	291.8	35.8	292.8	36.0	293.8	36.1	83
	286.2	40.2	287.2	40.4	288.2	40.5	289.2	40.6	290.1	40.8	291.1	40.9	292.1	41.1	293.1	41.2	82
	285.4	45.2	286.4	45.4	287.4	45.5	288.4	45.7	289.4	45.8	290.4	46.0	291.4	46.1	292.4	46.3	81
	284.6	50.2	285.6	50.4	286.6	50.5	287.6	50.7	288.5	50.9	289.5	51.1	290.5	51.2	291.5	51.4	80
3	283.7	55.1	284.7	55.3	285.7	55.5	286.6	55.7	287.6	55.9	288.6	56.1	289.6	56.3	290.6	56.5	79
	282.7	60.1	283.7	60.3	284.6	60.5	285.6	60.7	286.6	60.9	287.6	61.1	288.6	61.3	289.6	61.5	78
	281.6	65.0	282.6	65.2	283.5	65.3	284.5	65.7	285.5	65.9	286.5	66.1	287.4	66.4	288.4	66.6	77
	280.4	69.9	281.4	70.2	282.4	70.4	283.3	70.6	284.3	70.9	285.3	71.1	286.2	71.4	287.2	71.6	76
	279.2	74.8	280.1	75.1	281.1	75.3	282.1	75.6	283.0	75.8	284.0	76.1	284.9	76.4	285.9	76.6	75
4	277.8	79.7	278.8	79.9	279.7	80.2	280.7	80.5	281.6	80.8	282.6	81.0	283.6	81.3	284.5	81.6	74
	276.4	84.5	277.3	84.8	278.3	85.1	279.2	85.4	280.2	85.7	281.2	86.0	282.1	86.2	283.1	86.5	73
	274.9	89.3	275.8	89.6	276.8	89.9	277.7	90.2	278.7	90.5	279.6	90.9	280.6	91.2	281.5	91.5	72
	273.3	94.1	274.2	94.4	275.1	94.7	276.1	95.1	277.0	95.4	278.0	95.7	278.9	96.0	279.9	96.4	71
	271.6	98.8	272.5	99.2	273.5	99.5	274.4	99.9	275.3	100.2	276.3	100.6	277.2	100.9	278.1	101.2	70
21	269.8	103.6	270.7	103.9	271.7	104.3	272.6	104.6	273.5	105.0	274.5	105.4	275.4	105.7	276.3	106.1	69
	268.0	108.3	268.9	108.6	269.8	109.0	270.7	109.4	271.7	109.8	272.6	110.1	273.5	110.5	274.4	110.9	68
	266.0	112.9	266.9	113.3	267.9	113.7	268.8	114.1	269.7	114.5	270.6	114.9	271.5	115.3	272.5	115.7	67
	264.0	117.5	264.9	118.0	265.8	118.4	266.8	118.8	267.7	119.2	268.6	119.6	269.5	120.0	270.4	120.4	66
	261.9	122.1	262.8	122.6	263.7	123.0	264.6	123.4	265.5	123.8	266.5	124.2	267.4	124.7	268.3	125.1	65
25	259.8	126.7	260.7	127.1	261.5	127.6	262.4	128.0	263.3	128.4	264.2	128.9	265.1	129.3	266.0	129.8	64
	257.5	131.2	258.4	131.7	259.3	132.1	260.2	132.6	261.1	133.0	262.0	133.5	262.8	133.9	263.7	134.4	63
	255.2	135.7	256.1	136.1	256.9	136.6	257.8	137.1	258.7	137.6	259.6	138.0	260.5	138.5	261.3	139.0	62
	252.8	140.1	253.6	140.6	254.5	141.1	255.4	141.6	256.3	142.0	257.1	142.5	258.0	143.0	258.9	143.5	61
	250.3	144.5	251.1	145.0	252.0	145.5	252.9	146.0	253.7	146.5	254.6	147.0	255.5	147.5	256.3	148.0	60
31	247.7	148.8	248.6	149.4	249.4	149.9	250.3	150.4	251.2	150.9	252.0	151.4	252.9	151.9	253.7	152.5	59
	245.1	153.1	245.9	153.7	246.8	154.2	247.6	154.7	248.5	155.3	249.3	155.8	250.2	156.3	251.0	156.9	58
	242.4	157.4	243.2	157.9	244.1	158.5	244.9	159.0	245.7	159.6	246.6	160.1	247.4	160.7	248.2	161.2	57
	239.6	161.6	240.4	162.2	241.2	162.7	242.1	163.3	242.9	163.8	243.7	164.4	244.6	165.0	245.4	165.5	56
	236.7	165.8	237.6	166.3	238.4	166.9	239.2	167.5	240.0	168.1	240.8	168.6	241.6	169.2	242.5	169.8	55
36	233.8	169.9	234.6	170.5	235.4	171.0	236.2	171.6	237.0	172.2	237.9	172.8	233.7	173.4	239.5	174.0	54
	230.8	173.9	231.6	174.5	232.4	175.1	233.2	175.7	234.0	176.3	234.8	176.9	235.6	177.5	236.4	178.1	53
	227.7	177.9	228.5	178.5	229.3	179.2	230.1	179.8	230.9	180.4	231.7	181.0	232.5	181.6	233.3	182.2	52
	224.6	181.9	225.4	182.5	226.1	183.1	226.9	183.8	227.7	184.4	228.5	185.0	229.3	185.6	230.0	186.3	51
	221.4	185.8	222.2	186.4	222.9	187.1	223.7	187.7	224.5	188.3	225.2	189.0	226.0	189.6	226.7	190.3	50
41	218.1	189.6	218.9	190.3	219.6	190.9	220.4	191.6	221.1	192.2	221.9	192.9	222.6	193.5	223.4	194.2	49
	214.8	193.4	215.5	194.0	216.3	194.7	217.0	195.4	217.7	196.1	218.5	196.7	219.2	197.4	220.0	198.1	48
	211.4	197.1	212.1	197.8	212.8	198.5	213.6	199.1	214.3	199.8	215.0	200.5	215.7	201.2	216.5	201.9	47
	207.9	200.8	208.6	201.5	209.3	202.1	210.0	202.8	210.8	203.5	211.5	204.2	212.2	204.9	212.9	205.6	46
	204.3	204.3	205.1	205.1	205.8	205.8	206.5	206.5	207.2	207.2	207.9	207.9	208.6	208.6	209.3	209.3	45
Crs.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Dep.	Diff. Lat.	Crs.

Meridional Parts.

(y)

Lat.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	
0	0.00	60.00	120.02	180.08	240.19	300.38	360.66	421.05	481.57	542.23	603.07	0'
1	1.00	61.00	121.02	181.08	241.20	301.38	361.66	422.06	482.58	543.25	604.08	1
2	2.00	62.00	122.03	182.08	242.20	302.39	362.67	423.06	483.59	544.26	605.10	2
3	3.00	63.00	123.03	183.09	243.20	303.39	363.67	424.07	484.60	545.27	606.12	3
4	4.00	64.00	124.03	184.09	244.20	304.40	364.68	425.08	485.61	546.28	607.13	4
5	5.00	65.00	125.03	185.09	245.21	305.40	365.69	426.09	486.62	547.30	608.15	5
6	6.00	66.00	126.03	186.09	246.21	306.40	366.69	427.09	487.63	548.31	609.16	6
7	7.00	67.00	127.03	187.09	247.21	307.41	367.70	428.10	488.64	549.32	610.18	7
8	8.00	68.00	128.03	188.09	248.21	308.41	368.70	429.11	489.65	550.34	611.19	8
9	9.00	69.00	129.03	189.09	249.22	309.42	369.71	430.12	490.66	551.35	612.21	9
10	10.00	70.00	130.03	190.10	250.22	310.42	370.72	431.13	491.67	552.36	613.23	10
11	11.00	71.00	131.03	191.10	251.22	311.42	371.72	432.13	492.68	553.37	614.24	11
12	12.00	72.00	132.03	192.10	252.23	312.43	372.73	433.14	493.69	554.39	615.26	12
13	13.00	73.00	133.03	193.10	253.23	313.43	373.74	434.15	494.70	555.40	616.27	13
14	14.00	74.01	134.03	194.10	254.23	314.44	374.74	435.16	495.71	556.41	617.29	14
15	15.00	75.01	135.03	195.10	255.23	315.44	375.75	436.17	496.72	557.43	618.31	15
16	16.00	76.01	136.03	196.11	256.24	316.45	376.75	437.17	497.73	558.44	619.32	16
17	17.00	77.01	137.04	197.11	257.24	317.45	377.76	438.18	498.74	559.45	620.34	17
18	18.00	78.01	138.04	198.11	258.24	318.45	378.76	439.19	499.75	560.47	621.36	18
19	19.00	79.01	139.04	199.11	259.25	319.46	379.77	440.20	500.76	561.48	622.37	19
20	20.00	80.01	140.04	200.11	260.25	320.46	380.78	441.21	501.77	562.49	623.39	20
21	21.00	81.01	141.04	201.11	261.25	321.47	381.78	442.21	502.78	563.51	624.40	21
22	22.00	82.01	142.04	202.12	262.25	322.47	382.79	443.22	503.79	564.52	625.42	22
23	23.00	83.01	143.04	203.12	263.26	323.48	383.79	444.23	504.80	565.53	626.44	23
24	24.00	84.01	144.04	204.12	264.26	324.48	384.80	445.24	505.81	566.55	627.45	24
25	25.00	85.01	145.04	205.12	265.26	325.48	385.81	446.25	506.83	567.56	628.47	25
26	26.00	86.01	146.04	206.12	266.27	326.49	386.81	447.26	507.84	568.57	629.49	26
27	27.00	87.01	147.04	207.13	267.27	327.49	387.82	448.26	508.85	569.59	630.50	27
28	28.00	88.01	148.05	208.13	268.27	328.50	388.83	449.27	509.86	570.60	631.52	28
29	29.00	89.01	149.05	209.13	269.27	329.50	389.83	450.28	510.87	571.62	632.54	29
30	30.00	90.01	150.05	210.13	270.28	330.51	390.84	451.29	511.88	572.63	633.56	30
31	31.00	91.01	151.05	211.13	271.28	331.51	391.85	452.30	512.89	573.64	634.57	31
32	32.00	92.01	152.05	212.13	272.28	332.52	392.85	453.31	513.90	574.66	635.59	32
33	33.00	93.01	153.05	213.14	273.29	333.52	393.86	454.32	514.91	575.67	636.61	33
34	34.00	94.01	154.05	214.14	274.29	334.53	394.86	455.33	515.93	576.69	637.62	34
35	35.00	95.01	155.05	215.14	275.29	335.53	395.87	456.33	516.94	577.70	638.64	35
36	36.00	96.01	156.05	216.14	276.30	336.54	396.88	457.34	517.95	578.71	639.66	36
37	37.00	97.01	157.05	217.14	277.30	337.54	397.88	458.35	518.96	579.73	640.68	37
38	38.00	98.01	158.06	218.15	278.30	338.55	398.89	459.36	519.97	580.74	641.69	38
39	39.00	99.01	159.06	219.15	279.31	339.55	399.90	460.37	520.98	581.76	642.71	39
40	40.00	100.01	160.06	220.15	280.31	340.56	400.91	461.38	521.99	582.77	643.73	40
41	41.00	101.01	161.06	221.15	281.31	341.56	401.91	462.39	523.01	583.79	644.75	41
42	42.00	102.01	162.06	222.15	282.32	342.57	402.92	463.40	524.02	584.80	645.76	42
43	43.00	103.02	163.06	223.16	283.32	343.57	403.93	464.41	525.03	585.81	646.78	43
44	44.00	104.02	164.06	224.16	284.32	344.58	404.93	465.41	526.04	586.83	647.80	44
45	45.00	105.02	165.06	225.16	285.33	345.58	405.94	466.42	527.05	587.84	648.82	45
46	46.00	106.02	166.06	226.16	286.33	346.59	406.95	467.43	528.06	588.86	649.84	46
47	47.00	107.02	167.07	227.16	287.33	347.59	407.95	468.44	529.08	589.87	650.85	47
48	48.00	108.02	168.07	228.17	288.34	348.60	408.96	469.45	530.09	590.89	651.87	48
49	49.00	109.02	169.07	229.17	289.34	349.60	409.97	470.46	531.10	591.90	652.89	49
50	50.00	110.02	170.07	230.17	290.34	350.61	410.97	471.47	532.11	592.92	653.91	50
51	51.00	111.02	171.07	231.17	291.35	351.61	411.98	472.48	533.12	593.93	654.93	51
52	52.00	112.02	172.07	232.18	292.35	352.62	412.99	473.49	534.14	594.95	655.94	52
53	53.00	113.02	173.07	233.18	293.35	353.62	414.00	474.50	535.15	595.96	656.96	53
54	54.00	114.02	174.07	234.18	294.36	354.63	415.00	475.51	536.16	596.98	657.98	54
55	55.00	115.02	175.07	235.18	295.36	355.63	416.01	476.52	537.17	597.99	659.00	55
56	56.00	116.02	176.08	236.18	296.37	356.64	417.02	477.53	538.18	599.01	660.02	56
57	57.00	117.02	177.08	237.19	297.37	357.64	418.03	478.54	539.20	600.02	661.04	57
58	58.00	118.02	178.08	238.19	298.37	358.65	419.03	479.55	540.21	601.04	662.05	58
59	59.00	119.02	179.08	239.19	299.38	359.65	420.04	480.56	541.22	602.05	663.07	59
60	60.00	120.02	180.08	240.19	300.38	360.66	421.05	481.57	542.23	603.07	664.09	60
Lat.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	

Meridional Parts.

(y)

Lat.	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	
0'	664.09	725.32	786.78	848.49	910.46	972.73	1035.30	1098.22	1161.49	1225.14	0'
1	665.11	726.34	787.81	849.52	911.50	973.77	1036.35	1099.27	1162.54	1226.20	1
2	666.13	727.37	788.83	850.55	912.53	974.81	1037.40	1100.32	1163.60	1227.27	2
3	667.15	728.39	789.86	851.58	913.57	975.85	1038.44	1101.37	1164.66	1228.33	3
4	668.17	729.41	790.89	852.61	914.60	976.89	1039.49	1102.42	1165.72	1229.40	4
5	669.19	730.43	791.91	853.64	915.64	977.93	1040.53	1103.47	1166.78	1230.46	5
6	670.21	731.46	792.94	854.67	916.67	978.97	1041.58	1104.53	1167.83	1231.53	6
7	671.22	732.48	793.97	855.70	917.71	980.01	1042.63	1105.58	1168.89	1232.59	7
8	672.24	733.50	794.99	856.73	918.75	981.05	1043.67	1106.63	1169.95	1233.66	8
9	673.26	734.53	796.02	857.76	919.78	982.09	1044.72	1107.68	1171.01	1234.72	9
10	674.28	735.55	797.04	858.80	920.82	983.13	1045.77	1108.74	1172.07	1235.79	10
11	675.30	736.57	798.07	859.83	921.85	984.17	1046.81	1109.79	1173.13	1236.85	11
12	676.32	737.59	799.10	860.86	922.89	985.22	1047.86	1110.84	1174.19	1237.92	12
13	677.34	738.62	800.13	861.89	923.93	986.26	1048.91	1111.89	1175.24	1238.98	13
14	678.36	739.64	801.15	862.92	924.96	987.30	1049.95	1112.95	1176.30	1240.05	14
15	679.38	740.66	802.18	863.95	926.00	988.34	1051.00	1114.00	1177.36	1241.11	15
16	680.40	741.69	803.21	864.98	927.03	989.38	1052.05	1115.05	1178.42	1242.18	16
17	681.42	742.71	804.24	866.02	928.07	990.42	1053.09	1116.11	1179.48	1243.25	17
18	682.44	743.73	805.26	867.05	929.11	991.47	1054.14	1117.16	1180.54	1244.31	18
19	683.46	744.76	806.29	868.08	930.15	992.51	1055.19	1118.21	1181.60	1245.38	19
20	684.48	745.78	807.32	869.11	931.18	993.55	1056.24	1119.27	1182.66	1246.44	20
21	685.50	746.81	808.35	870.14	932.22	994.59	1057.28	1120.32	1183.72	1247.51	21
22	686.52	747.83	809.37	871.18	933.26	995.63	1058.33	1121.37	1184.78	1248.58	22
23	687.54	748.85	810.40	872.21	934.29	996.68	1059.38	1122.43	1185.84	1249.64	23
24	688.56	749.88	811.43	873.24	935.33	997.72	1060.43	1123.48	1186.90	1250.71	24
25	689.58	750.90	812.46	874.27	936.37	998.76	1061.48	1124.53	1187.96	1251.78	25
26	690.60	751.92	813.49	875.31	937.40	999.80	1062.52	1125.59	1189.02	1252.85	26
27	691.62	752.95	814.52	876.34	938.44	1000.85	1063.57	1126.64	1190.08	1253.91	27
28	692.64	753.97	815.54	877.37	939.48	1001.89	1064.62	1127.70	1191.14	1254.98	28
29	693.66	755.00	816.57	878.40	940.52	1002.93	1065.67	1128.75	1192.20	1256.05	29
30	694.68	756.02	817.60	879.44	941.56	1003.97	1066.72	1129.81	1193.26	1257.12	30
31	695.70	757.05	818.63	880.47	942.59	1005.02	1067.77	1130.86	1194.32	1258.18	31
32	696.72	758.07	819.66	881.50	943.63	1006.06	1068.81	1131.92	1195.39	1259.25	32
33	697.74	759.09	820.69	882.54	944.67	1007.10	1069.86	1132.97	1196.45	1260.32	33
34	698.76	760.12	821.71	883.57	945.71	1008.15	1070.91	1134.03	1197.51	1261.39	34
35	699.78	761.14	822.74	884.60	946.74	1009.19	1071.96	1135.08	1198.57	1262.45	35
36	700.80	762.17	823.77	885.64	947.78	1010.23	1073.01	1136.14	1199.63	1263.52	36
37	701.82	763.19	824.80	886.67	948.82	1011.28	1074.06	1137.19	1200.69	1264.59	37
38	702.85	764.22	825.83	887.70	949.86	1012.32	1075.11	1138.25	1201.75	1265.66	38
39	703.87	765.24	826.86	888.74	950.90	1013.36	1076.16	1139.30	1202.82	1266.73	39
40	704.89	766.27	827.89	889.77	951.94	1014.41	1077.21	1140.36	1203.88	1267.80	40
41	705.91	767.29	828.92	890.80	952.98	1015.45	1078.26	1141.41	1204.94	1268.87	41
42	706.93	768.32	829.95	891.84	954.01	1016.50	1079.31	1142.47	1206.00	1269.93	42
43	707.95	769.34	830.98	892.87	955.05	1017.54	1080.36	1143.52	1207.06	1271.00	43
44	708.97	770.37	832.00	893.91	956.09	1018.58	1081.41	1144.58	1208.13	1272.07	44
45	709.99	771.39	833.03	894.94	957.13	1019.63	1082.46	1145.64	1209.19	1273.14	45
46	711.02	772.42	834.06	895.97	958.17	1020.67	1083.51	1146.69	1210.25	1274.21	46
47	712.04	773.44	835.09	897.01	959.21	1021.72	1084.56	1147.75	1211.31	1275.28	47
48	713.06	774.47	836.12	898.04	960.25	1022.76	1085.61	1148.80	1212.38	1276.35	48
49	714.08	775.49	837.15	899.08	961.29	1023.81	1086.66	1149.86	1213.44	1277.42	49
50	715.10	776.52	838.18	900.11	962.33	1024.85	1087.71	1150.92	1214.50	1278.49	50
51	716.12	777.54	839.21	901.15	963.37	1025.90	1088.76	1151.97	1215.57	1279.56	51
52	717.15	778.57	840.24	902.18	964.41	1026.94	1089.81	1153.03	1216.63	1280.63	52
53	718.17	779.59	841.27	903.22	965.45	1027.99	1090.86	1154.09	1217.69	1281.70	53
54	719.19	780.62	842.30	904.25	966.49	1029.03	1091.91	1155.14	1218.76	1282.77	54
55	720.21	781.65	843.33	905.28	967.53	1030.08	1092.96	1156.20	1219.82	1283.84	55
56	721.23	782.67	844.36	906.32	968.57	1031.12	1094.01	1157.26	1220.88	1284.91	56
57	722.26	783.70	845.39	907.35	969.61	1032.17	1095.06	1158.32	1221.95	1285.98	57
58	723.28	784.73	846.42	908.39	970.65	1033.21	1096.11	1159.37	1223.01	1287.05	58
59	724.30	785.75	847.45	909.43	971.69	1034.26	1097.16	1160.43	1224.07	1288.13	59
60	725.32	786.78	848.49	910.46	972.73	1035.30	1098.22	1161.49	1225.14	1289.20	60
Lat.	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	

Meridional Parts.

(y)

Lat.	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	
0'	1289.20	1353.69	1418.63	1484.06	1549.99	1616.47	1683.52	1751.16	1819.44	1888.38	0'
1	1290.27	1354.76	1419.72	1485.15	1551.10	1617.58	1684.64	1752.29	1820.58	1889.53	1
2	1291.34	1355.84	1420.80	1486.25	1552.20	1618.70	1685.76	1753.43	1821.72	1890.69	2
3	1292.41	1356.92	1421.89	1487.34	1553.31	1619.81	1686.88	1754.56	1822.87	1891.84	3
4	1293.48	1358.00	1422.98	1488.44	1554.41	1620.92	1688.01	1755.69	1824.01	1893.00	4
5	1294.55	1359.08	1424.06	1489.53	1555.51	1622.04	1689.13	1756.83	1825.16	1894.15	5
6	1295.63	1360.16	1425.15	1490.63	1556.62	1623.15	1690.25	1757.96	1826.30	1895.31	6
7	1296.70	1361.24	1426.24	1491.72	1557.72	1624.26	1691.38	1759.09	1827.44	1896.46	7
8	1297.77	1362.32	1427.32	1492.82	1558.83	1625.38	1692.50	1760.23	1828.59	1897.62	8
9	1298.84	1363.40	1428.41	1493.91	1559.93	1626.49	1693.62	1761.36	1829.73	1898.78	9
10	1299.91	1364.48	1429.50	1495.01	1561.04	1627.61	1694.75	1762.50	1830.88	1899.93	10
11	1300.99	1365.56	1430.59	1496.11	1562.14	1628.72	1695.87	1763.63	1832.02	1901.09	11
12	1302.06	1366.64	1431.68	1497.20	1563.25	1629.84	1697.00	1764.77	1833.17	1902.25	12
13	1303.13	1367.72	1432.76	1498.30	1564.35	1630.95	1698.12	1765.90	1834.32	1903.40	13
14	1304.20	1368.80	1433.85	1499.40	1565.46	1632.06	1699.25	1767.04	1835.46	1904.56	14
15	1305.28	1369.88	1434.94	1500.49	1566.56	1633.18	1700.37	1768.17	1836.61	1905.72	15
16	1306.35	1370.96	1436.03	1501.59	1567.67	1634.29	1701.50	1769.31	1837.75	1906.88	16
17	1307.42	1372.04	1437.12	1502.69	1568.77	1635.41	1702.62	1770.44	1838.90	1908.03	17
18	1308.50	1373.12	1438.21	1503.78	1569.88	1636.52	1703.75	1771.58	1840.05	1909.19	18
19	1309.57	1374.20	1439.29	1504.88	1570.99	1637.64	1704.87	1772.71	1841.19	1910.35	19
20	1310.64	1375.28	1440.38	1505.98	1572.09	1638.76	1706.00	1773.85	1842.34	1911.51	20
21	1311.72	1376.36	1441.47	1507.08	1573.20	1639.87	1707.12	1774.98	1843.49	1912.67	21
22	1312.79	1377.44	1442.56	1508.17	1574.31	1640.99	1708.25	1776.12	1844.64	1913.83	22
23	1313.86	1378.52	1443.65	1509.27	1575.41	1642.10	1709.37	1777.26	1845.78	1914.98	23
24	1314.94	1379.61	1444.74	1510.37	1576.52	1643.22	1710.50	1778.39	1846.93	1916.14	24
25	1316.01	1380.69	1445.83	1511.47	1577.63	1644.34	1711.63	1779.53	1848.08	1917.30	25
26	1317.08	1381.77	1446.92	1512.57	1578.73	1645.45	1712.75	1780.67	1849.23	1918.46	26
27	1318.16	1382.85	1448.01	1513.67	1579.84	1646.57	1713.88	1781.81	1850.37	1919.62	27
28	1319.23	1383.93	1449.10	1514.76	1580.95	1647.69	1715.01	1782.94	1851.52	1920.78	28
29	1320.31	1385.02	1450.19	1515.86	1582.06	1648.80	1716.14	1784.08	1852.67	1921.94	29
30	1321.38	1386.10	1451.28	1516.96	1583.17	1649.92	1717.26	1785.22	1853.82	1923.10	30
31	1322.45	1387.18	1452.37	1518.06	1584.27	1651.04	1718.39	1786.36	1854.97	1924.26	31
32	1323.53	1388.26	1453.46	1519.16	1585.38	1652.16	1719.52	1787.50	1856.12	1925.43	32
33	1324.60	1389.35	1454.55	1520.26	1586.49	1653.27	1720.65	1788.63	1857.27	1926.59	33
34	1325.68	1390.43	1455.64	1521.36	1587.60	1654.39	1721.77	1789.77	1858.42	1927.75	34
35	1326.75	1391.51	1456.73	1522.46	1588.71	1655.51	1722.90	1790.91	1859.57	1928.91	35
36	1327.83	1392.59	1457.83	1523.56	1589.82	1656.63	1724.03	1792.05	1860.72	1930.07	36
37	1328.90	1393.68	1458.92	1524.66	1590.92	1657.75	1725.16	1793.19	1861.87	1931.23	37
38	1329.98	1394.76	1460.01	1525.76	1592.03	1658.87	1726.29	1794.33	1863.02	1932.40	38
39	1331.06	1395.84	1461.10	1526.86	1593.14	1659.98	1727.42	1795.47	1864.17	1933.56	39
40	1332.13	1396.93	1462.19	1527.96	1594.25	1661.10	1728.54	1796.61	1865.32	1934.72	40
41	1333.21	1398.01	1463.28	1529.06	1595.36	1662.22	1729.67	1797.75	1866.47	1935.88	41
42	1334.29	1399.10	1464.38	1530.16	1596.47	1663.34	1730.80	1798.89	1867.62	1937.05	42
43	1335.37	1400.18	1465.47	1531.26	1597.58	1664.46	1731.93	1800.03	1868.77	1938.21	43
44	1336.44	1401.26	1466.56	1532.36	1598.69	1665.58	1733.06	1801.17	1869.92	1939.37	44
45	1337.52	1402.35	1467.65	1533.46	1599.80	1666.70	1734.19	1802.31	1871.08	1940.54	45
46	1338.60	1403.43	1468.75	1534.56	1600.91	1667.82	1735.32	1803.45	1872.23	1941.70	46
47	1339.67	1404.52	1469.84	1535.66	1602.02	1668.94	1736.45	1804.59	1873.38	1942.86	47
48	1340.75	1405.60	1470.93	1536.77	1603.13	1670.06	1737.58	1805.73	1874.53	1944.03	48
49	1341.83	1406.69	1472.02	1537.87	1604.24	1671.18	1738.71	1806.87	1875.69	1945.19	49
50	1342.91	1407.77	1473.12	1538.97	1605.35	1672.30	1739.84	1808.01	1876.84	1946.36	50
51	1343.98	1408.86	1474.21	1540.07	1606.46	1673.42	1740.98	1809.15	1877.99	1947.52	51
52	1345.06	1409.94	1475.30	1541.17	1607.58	1674.54	1742.11	1810.30	1879.14	1948.69	52
53	1346.14	1411.03	1476.40	1542.27	1608.69	1675.66	1743.24	1811.44	1880.30	1949.85	53
54	1347.22	1412.11	1477.49	1543.38	1609.80	1676.79	1744.37	1812.58	1881.45	1951.02	54
55	1348.29	1413.20	1478.59	1544.48	1610.91	1677.91	1745.50	1813.72	1882.60	1952.18	55
56	1349.37	1414.28	1479.68	1545.58	1612.02	1679.03	1746.63	1814.86	1883.76	1953.35	56
57	1350.45	1415.37	1480.77	1546.69	1613.13	1680.15	1747.76	1816.01	1884.91	1954.51	57
58	1351.53	1416.46	1481.87	1547.79	1614.25	1681.27	1748.90	1817.15	1886.07	1955.68	58
59	1352.61	1417.54	1482.96	1548.89	1615.36	1682.39	1750.03	1818.29	1887.22	1956.85	59
60	1353.69	1418.63	1484.06	1549.99	1616.47	1683.52	1751.16	1819.44	1888.38	1958.01	60
Lat.	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	

Meridional Parts.

(y)

Lat.	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	
0'	1958.01	2028.38	2099.53	2171.48	2244.29	2317.99	2392.63	2468.26	2544.93	2622.69	0'
1	1959.18	2029.56	2100.72	2172.69	2245.51	2319.2	2393.88	2469.53	2546.22	2624.00	1
2	1960.35	2030.74	2101.91	2173.89	2246.73	2320.46	2395.14	2470.80	2547.50	2625.30	2
3	1961.51	2031.92	2103.10	2175.10	2247.95	2321.70	2396.39	2472.07	2548.79	2626.61	3
4	1962.68	2033.10	2104.30	2176.31	2249.17	2322.93	2397.64	2473.34	2550.08	2627.91	4
5	1963.85	2034.28	2105.49	2177.51	2250.39	2324.17	2398.90	2474.61	2551.37	2629.22	5
6	1965.02	2035.46	2106.68	2178.72	2251.62	2325.41	2400.15	2475.88	2552.66	2630.53	6
7	1966.18	2036.64	2107.88	2179.93	2252.84	2326.65	2401.40	2477.15	2553.95	2631.84	7
8	1967.35	2037.82	2109.07	2181.14	2254.06	2327.89	2402.66	2478.42	2555.23	2633.14	8
9	1968.52	2039.00	2110.27	2182.35	2255.28	2329.12	2403.91	2479.69	2556.52	2634.45	9
10	1969.69	2040.19	2111.46	2183.55	2256.51	2330.36	2405.17	2480.97	2557.81	2635.76	10
11	1970.86	2041.37	2112.66	2184.76	2257.73	2331.60	2406.42	2482.24	2559.10	2637.07	11
12	1972.03	2042.55	2113.85	2185.97	2258.95	2332.84	2407.68	2483.51	2560.39	2638.38	12
13	1973.20	2043.73	2115.05	2187.18	2260.18	2334.08	2408.93	2484.78	2561.68	2639.69	13
14	1974.37	2044.91	2116.24	2188.39	2261.40	2335.32	2410.19	2486.06	2562.97	2641.00	14
15	1975.54	2046.10	2117.44	2189.60	2262.63	2336.56	2411.44	2487.33	2564.27	2642.31	15
16	1976.71	2047.28	2118.63	2190.81	2263.85	2337.80	2412.70	2488.60	2565.56	2643.62	16
17	1977.88	2048.46	2119.83	2192.02	2265.08	2339.04	2413.96	2489.88	2566.85	2644.93	17
18	1979.05	2049.64	2121.03	2193.23	2266.30	2340.28	2415.21	2491.15	2568.14	2646.24	18
19	1980.22	2050.83	2122.22	2194.44	2267.53	2341.52	2416.47	2492.43	2569.43	2647.55	19
20	1981.39	2052.01	2123.42	2195.65	2268.75	2342.76	2417.73	2493.70	2570.73	2648.86	20
21	1982.56	2053.19	2124.62	2196.86	2269.98	2344.00	2418.99	2494.97	2572.02	2650.17	21
22	1983.73	2054.38	2125.81	2198.07	2271.20	2345.25	2420.24	2496.25	2573.31	2651.49	22
23	1984.90	2055.56	2127.01	2199.29	2272.43	2346.49	2421.50	2497.52	2574.61	2652.80	23
24	1986.07	2056.75	2128.21	2200.50	2273.66	2347.73	2422.76	2498.80	2575.90	2654.11	24
25	1987.24	2057.93	2129.41	2201.71	2274.88	2348.97	2424.02	2500.08	2577.19	2655.43	25
26	1988.41	2059.11	2130.61	2202.92	2276.11	2350.21	2425.28	2501.35	2578.49	2656.74	26
27	1989.59	2060.30	2131.80	2204.14	2277.34	2351.46	2426.54	2502.63	2579.78	2658.05	27
28	1990.76	2061.49	2133.00	2205.35	2278.57	2352.70	2427.80	2503.91	2581.08	2659.37	28
29	1991.93	2062.67	2134.20	2206.56	2279.79	2353.95	2429.06	2505.18	2582.37	2660.68	29
30	1993.10	2063.86	2135.40	2207.78	2281.02	2355.19	2430.32	2506.46	2583.67	2662.00	30
31	1994.28	2065.04	2136.60	2208.99	2282.25	2356.43	2431.58	2507.74	2584.97	2663.31	31
32	1995.45	2066.23	2137.80	2210.20	2283.48	2357.68	2432.84	2509.02	2586.26	2664.63	32
33	1996.62	2067.41	2139.00	2211.42	2284.71	2358.92	2434.10	2510.30	2587.56	2665.94	33
34	1997.80	2068.60	2140.20	2212.63	2285.94	2360.17	2435.36	2511.58	2588.86	2667.26	34
35	1998.97	2069.79	2141.40	2213.84	2287.17	2361.41	2436.62	2512.86	2590.15	2668.58	35
36	2000.14	2070.97	2142.60	2215.06	2288.40	2362.66	2437.89	2514.14	2591.45	2669.89	36
37	2001.32	2072.16	2143.80	2216.27	2289.63	2363.90	2439.15	2515.41	2592.75	2671.21	37
38	2002.49	2073.35	2145.00	2217.49	2290.86	2365.15	2440.41	2516.69	2594.05	2672.53	38
39	2003.67	2074.54	2146.20	2218.70	2292.09	2366.40	2441.68	2517.97	2595.35	2673.85	39
40	2004.84	2075.72	2147.40	2219.92	2293.32	2367.64	2442.94	2519.25	2596.65	2675.16	40
41	2006.02	2076.91	2148.61	2221.14	2294.55	2368.89	2444.20	2520.54	2597.95	2676.48	41
42	2007.19	2078.10	2149.81	2222.35	2295.78	2370.14	2445.47	2521.82	2599.24	2677.80	42
43	2008.37	2079.29	2151.01	2223.57	2297.01	2371.38	2446.73	2523.10	2600.54	2679.12	43
44	2009.54	2080.48	2152.21	2224.79	2298.24	2372.63	2447.99	2524.38	2601.84	2680.44	44
45	2010.72	2081.67	2153.41	2226.00	2299.48	2373.88	2449.26	2525.66	2603.14	2681.76	45
46	2011.90	2082.86	2154.62	2227.22	2300.71	2375.13	2450.52	2526.95	2604.45	2683.08	46
47	2013.07	2084.04	2155.82	2228.44	2301.94	2376.38	2451.79	2528.23	2605.75	2684.40	47
48	2014.25	2085.23	2157.02	2229.66	2303.17	2377.63	2453.05	2529.51	2607.05	2685.72	48
49	2015.43	2086.42	2158.23	2230.87	2304.41	2378.87	2454.32	2530.79	2608.35	2687.04	49
50	2016.60	2087.61	2159.43	2232.09	2305.64	2380.12	2455.58	2532.08	2609.65	2688.36	50
51	2017.78	2088.80	2160.63	2233.31	2306.88	2381.37	2456.85	2533.36	2610.95	2689.69	51
52	2018.96	2089.99	2161.84	2234.53	2308.11	2382.62	2458.12	2534.65	2612.26	2691.01	52
53	2020.13	2091.19	2163.04	2235.75	2309.34	2383.87	2459.39	2535.93	2613.56	2692.33	53
54	2021.31	2092.38	2164.25	2236.97	2310.58	2385.12	2460.65	2537.22	2614.86	2693.65	54
55	2022.49	2093.57	2165.45	2238.19	2311.81	2386.37	2461.92	2538.50	2616.17	2694.98	55
56	2023.67	2094.76	2166.66	2239.41	2313.05	2387.62	2463.19	2539.79	2617.47	2696.30	56
57	2024.85	2095.95	2167.86	2240.63	2314.28	2388.88	2464.46	2541.07	2618.78	2697.63	57
58	2026.03	2097.14	2169.07	2241.85	2315.52	2390.13	2465.72	2542.36	2620.08	2698.95	58
59	2027.20	2098.33	2170.28	2243.07	2316.75	2391.38	2466.99	2543.64	2621.38	2700.27	59
60	2028.38	2099.53	2171.48	2244.29	2317.99	2392.63	2468.26	2544.93	2622.69	2701.60	60
Lat.	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	

Meridional Parts.

(y)

Lat.	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	
0'	2701.60	2781.71	2863.10	2945.81	3029.94	3115.55	3202.71	3291.53	3382.08	3474.47	0'
1	2702.92	2783.06	2864.46	2947.21	3031.35	3116.99	3204.18	3293.02	3383.61	3476.03	1
2	2704.25	2784.40	2865.83	2948.60	3032.77	3118.43	3205.65	3294.52	3385.13	3477.59	2
3	2705.57	2785.75	2867.20	2949.99	3034.18	3119.87	3207.12	3296.01	3386.66	3479.14	3
4	2706.90	2787.09	2868.57	2951.38	3035.60	3121.31	3208.58	3297.51	3388.18	3480.70	4
5	2708.23	2788.44	2869.94	2952.77	3037.02	3122.75	3210.05	3299.01	3389.71	3482.26	5
6	2709.55	2789.79	2871.31	2954.16	3038.43	3124.19	3211.52	3300.51	3391.24	3483.82	6
7	2710.88	2791.14	2872.68	2955.56	3039.85	3125.63	3212.99	3302.00	3392.77	3485.38	7
8	2712.21	2792.49	2874.05	2956.95	3041.27	3127.08	3214.46	3303.50	3394.29	3486.94	8
9	2713.54	2793.84	2875.42	2958.34	3042.68	3128.52	3215.93	3305.00	3395.82	3488.50	9
10	2714.86	2795.19	2876.79	2959.74	3044.10	3129.96	3217.40	3306.50	3397.35	3490.06	10
11	2716.19	2796.54	2878.16	2961.13	3045.52	3131.41	3218.87	3308.00	3398.88	3491.62	11
12	2717.52	2797.89	2879.53	2962.53	3046.94	3132.85	3220.34	3309.50	3400.41	3493.18	12
13	2718.85	2799.24	2880.90	2963.92	3048.36	3134.30	3221.82	3311.00	3401.94	3494.74	13
14	2720.18	2800.59	2882.28	2965.32	3049.78	3135.75	3223.29	3312.50	3403.47	3496.31	14
15	2721.51	2801.94	2883.65	2966.71	3051.20	3137.19	3224.76	3314.00	3405.00	3497.87	15
16	2722.84	2803.29	2885.02	2968.11	3052.62	3138.64	3226.23	3315.50	3406.54	3499.43	16
17	2724.17	2804.64	2886.39	2969.50	3054.04	3140.08	3227.71	3317.00	3408.07	3501.00	17
18	2725.50	2805.99	2887.77	2970.90	3055.46	3141.53	3229.18	3318.51	3409.60	3502.56	18
19	2726.83	2807.34	2889.14	2972.30	3056.88	3142.98	3230.66	3320.01	3411.14	3504.13	19
20	2728.17	2808.70	2890.52	2973.70	3058.31	3144.42	3232.13	3321.52	3412.67	3505.70	20
21	2729.50	2810.05	2891.89	2975.09	3059.73	3145.87	3233.61	3323.02	3414.20	3507.26	21
22	2730.83	2811.40	2893.27	2976.49	3061.15	3147.32	3235.08	3324.53	3415.74	3508.83	22
23	2732.16	2812.76	2894.64	2977.89	3062.58	3148.77	3236.56	3326.03	3417.28	3510.40	23
24	2733.50	2814.11	2896.02	2979.29	3064.00	3150.22	3238.04	3327.54	3418.81	3511.97	24
25	2734.83	2815.46	2897.40	2980.69	3065.42	3151.67	3239.52	3329.04	3420.35	3513.54	25
26	2736.16	2816.82	2898.77	2982.09	3066.85	3153.12	3240.99	3330.55	3421.89	3515.11	26
27	2737.50	2818.17	2900.15	2983.49	3068.27	3154.57	3242.47	3332.06	3423.43	3516.68	27
28	2738.83	2819.53	2901.53	2984.89	3069.70	3156.03	3243.95	3333.56	3424.96	3518.25	28
29	2740.17	2820.88	2902.91	2986.29	3071.13	3157.48	3245.43	3335.07	3426.50	3519.82	29
30	2741.50	2822.24	2904.28	2987.70	3072.55	3158.93	3246.91	3336.58	3428.04	3521.39	30
31	2742.84	2823.60	2905.66	2989.10	3073.98	3160.38	3248.39	3338.09	3429.58	3522.96	31
32	2744.17	2824.95	2907.04	2990.50	3075.41	3161.84	3249.87	3339.60	3431.12	3524.54	32
33	2745.51	2826.31	2908.42	2991.90	3076.84	3163.29	3251.35	3341.11	3432.66	3526.11	33
34	2746.84	2827.67	2909.80	2993.31	3078.26	3164.74	3252.84	3342.62	3434.20	3527.68	34
35	2748.18	2829.03	2911.18	2994.71	3079.69	3166.20	3254.32	3344.14	3435.75	3529.26	35
36	2749.52	2830.39	2912.56	2996.12	3081.12	3167.65	3255.80	3345.65	3437.29	3530.83	36
37	2750.85	2831.74	2913.94	2997.52	3082.55	3169.11	3257.28	3347.16	3438.83	3532.41	37
38	2752.19	2833.10	2915.32	2998.93	3083.98	3170.57	3258.77	3348.67	3440.38	3533.99	38
39	2753.53	2834.46	2916.71	3000.33	3085.41	3172.02	3260.25	3350.19	3441.92	3535.56	39
40	2754.87	2835.82	2918.09	3001.74	3086.84	3173.48	3261.74	3351.70	3443.47	3537.14	40
41	2756.21	2837.18	2919.47	3003.14	3088.27	3174.94	3263.22	3353.21	3445.01	3538.72	41
42	2757.55	2838.54	2920.85	3004.55	3089.70	3176.40	3264.71	3354.73	3446.56	3540.30	42
43	2758.89	2839.90	2922.24	3005.96	3091.14	3177.85	3266.19	3356.24	3448.10	3541.88	43
44	2760.23	2841.27	2923.62	3007.36	3092.57	3179.31	3267.68	3357.76	3449.65	3543.45	44
45	2761.57	2842.63	2925.01	3008.77	3094.00	3180.77	3269.17	3359.28	3451.20	3545.04	45
46	2762.91	2843.99	2926.39	3010.18	3095.43	3182.23	3270.65	3360.79	3452.75	3546.62	46
47	2764.25	2845.35	2927.78	3011.59	3096.87	3183.69	3272.14	3362.31	3454.29	3548.20	47
48	2765.59	2846.71	2929.16	3013.00	3098.30	3185.15	3273.63	3363.83	3455.84	3549.78	48
49	2766.93	2848.08	2930.55	3014.41	3099.74	3186.61	3275.12	3365.35	3457.39	3551.36	49
50	2768.27	2849.44	2931.93	3015.82	3101.17	3188.07	3276.61	3366.87	3458.94	3552.94	50
51	2769.62	2850.81	2933.32	3017.23	3102.60	3189.54	3278.10	3368.39	3460.49	3554.53	51
52	2770.96	2852.17	2934.71	3018.64	3104.04	3191.00	3279.59	3369.91	3462.04	3556.11	52
53	2772.30	2853.53	2936.09	3020.05	3105.48	3192.46	3281.08	3371.43	3463.60	3557.70	53
54	2773.64	2854.90	2937.48	3021.46	3106.92	3193.92	3282.57	3372.95	3465.15	3559.28	54
55	2774.99	2856.26	2938.87	3022.87	3108.35	3195.39	3284.06	3374.47	3466.70	3560.87	55
56	2776.33	2857.63	2940.26	3024.29	3109.79	3196.85	3285.56	3375.99	3468.26	3562.45	56
57	2777.68	2858.99	2941.65	3025.70	3111.23	3198.32	3287.05	3377.51	3469.81	3564.04	57
58	2779.02	2860.36	2943.04	3027.11	3112.67	3199.78	3288.54	3379.04	3471.36	3565.63	58
59	2780.37	2861.73	2944.42	3028.52	3114.11	3201.25	3290.04	3380.56	3472.92	3567.22	59
60	2781.71	2863.10	2945.81	3029.94	3115.55	3202.71	3291.53	3382.08	3474.47	3568.81	60
Lat.	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	

Meridional Parts.

(y)

Lat.	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	
0'	3568.81	3665.19	3763.76	3864.64	3967.97	4073.90	4182.62	4294.30	4409.14	4527.37	0'
1	3570.40	3666.82	3765.42	3866.34	3969.71	4075.69	4184.46	4296.19	4411.08	4529.37	1
2	3571.99	3668.44	3767.09	3868.04	3971.46	4077.48	4186.29	4298.07	4413.03	4531.37	2
3	3573.58	3670.07	3768.75	3869.74	3973.20	4079.27	4188.13	4299.96	4414.97	4533.37	3
4	3575.17	3671.70	3770.41	3871.45	3974.95	4081.06	4189.97	4301.85	4416.92	4535.38	4
5	3576.76	3673.32	3772.08	3873.15	3976.69	4082.86	4191.81	4303.74	4418.86	4537.38	5
6	3578.35	3674.95	3773.74	3874.86	3978.44	4084.65	4193.65	4305.64	4420.81	4539.39	6
7	3579.94	3676.58	3775.41	3876.56	3980.19	4086.44	4195.49	4307.53	4422.76	4541.39	7
8	3581.54	3678.21	3777.08	3878.27	3981.94	4088.24	4197.34	4309.42	4424.70	4543.40	8
9	3583.13	3679.84	3778.74	3879.98	3983.69	4090.03	4199.18	4311.32	4426.65	4545.41	9
10	3584.73	3681.47	3780.41	3881.68	3985.44	4091.83	4201.02	4313.21	4428.60	4547.42	10
11	3586.32	3683.10	3782.08	3883.39	3987.19	4093.62	4202.87	4315.11	4430.56	4549.43	11
12	3587.92	3684.73	3783.75	3885.10	3988.94	4095.42	4204.71	4317.01	4432.51	4551.44	12
13	3589.51	3686.36	3785.42	3886.81	3990.69	4097.22	4206.56	4318.91	4434.46	4553.45	13
14	3591.11	3687.99	3787.09	3888.52	3992.45	4099.02	4208.41	4320.80	4436.42	4555.47	14
15	3592.71	3689.63	3788.76	3890.23	3994.20	4100.82	4210.26	4322.70	4438.37	4557.48	15
16	3594.30	3691.26	3790.43	3891.95	3995.96	4102.62	4212.10	4324.61	4440.33	4559.50	16
17	3595.90	3692.90	3792.10	3893.66	3997.71	4104.42	4213.95	4326.51	4442.29	4561.52	17
18	3597.50	3694.53	3793.78	3895.37	3999.47	4106.22	4215.80	4328.41	4444.24	4563.53	18
19	3599.10	3696.17	3795.45	3897.09	4001.22	4108.02	4217.66	4330.31	4446.20	4565.55	19
20	3600.70	3697.80	3797.12	3898.80	4002.98	4109.82	4219.51	4332.22	4448.16	4567.57	20
21	3602.30	3699.44	3798.80	3900.52	4004.74	4111.63	4221.36	4334.12	4450.12	4569.59	21
22	3603.90	3701.08	3800.47	3902.23	4006.50	4113.44	4223.22	4336.03	4452.09	4571.61	22
23	3605.50	3702.71	3802.15	3903.95	4008.26	4115.24	4225.07	4337.94	4454.05	4573.64	23
24	3607.11	3704.35	3803.83	3905.67	4010.02	4117.05	4226.93	4339.84	4456.01	4575.66	24
25	3608.71	3705.99	3805.50	3907.38	4011.78	4118.85	4228.78	4341.75	4457.98	4577.69	25
26	3610.32	3707.63	3807.18	3909.10	4013.54	4120.66	4230.64	4343.66	4459.94	4579.71	26
27	3611.92	3709.27	3808.86	3910.82	4015.31	4122.47	4232.50	4345.57	4461.91	4581.74	27
28	3613.52	3710.91	3810.54	3912.54	4017.07	4124.28	4234.36	4347.48	4463.88	4583.77	28
29	3615.13	3712.56	3812.22	3914.26	4018.84	4126.09	4236.22	4349.40	4465.85	4585.80	29
30	3616.74	3714.20	3813.90	3915.99	4020.60	4127.90	4238.08	4351.31	4467.82	4587.83	30
31	3618.34	3715.84	3815.58	3917.71	4022.37	4129.72	4239.94	4353.23	4469.79	4589.86	31
32	3619.95	3717.48	3817.27	3919.43	4024.13	4131.53	4241.80	4355.14	4471.76	4591.89	32
33	3621.56	3719.13	3818.95	3921.16	4025.90	4133.34	4243.67	4357.06	4473.73	4593.92	33
34	3623.17	3720.77	3820.63	3922.88	4027.67	4135.16	4245.53	4358.97	4475.71	4595.96	34
35	3624.78	3722.42	3822.32	3924.61	4029.44	4136.97	4247.39	4360.89	4477.68	4598.00	35
36	3626.39	3724.06	3824.00	3926.33	4031.21	4138.79	4249.26	4362.81	4479.66	4600.03	36
37	3628.00	3725.71	3825.69	3928.06	4032.98	4140.61	4251.13	4364.73	4481.63	4602.07	37
38	3629.61	3727.36	3827.37	3929.79	4034.75	4142.42	4252.99	4366.65	4483.61	4604.11	38
39	3631.22	3729.01	3829.06	3931.51	4036.52	4144.24	4254.86	4368.57	4485.59	4606.15	39
40	3632.83	3730.66	3830.75	3933.24	4038.29	4146.06	4256.73	4370.50	4487.57	4608.19	40
41	3634.44	3732.30	3832.43	3934.97	4040.07	4147.88	4258.60	4372.42	4489.55	4610.23	41
42	3636.06	3733.95	3834.12	3936.70	4041.84	4149.70	4260.47	4374.34	4491.53	4612.27	42
43	3637.67	3735.61	3835.81	3938.43	4043.61	4151.52	4262.34	4376.27	4493.51	4614.32	43
44	3639.28	3737.26	3837.50	3940.16	4045.39	4153.35	4264.22	4378.20	4495.50	4616.36	44
45	3640.90	3738.91	3839.19	3941.90	4047.17	4155.17	4266.09	4380.12	4497.48	4618.41	45
46	3642.51	3740.56	3840.88	3943.63	4048.94	4157.00	4267.97	4382.05	4499.47	4620.45	46
47	3644.13	3742.21	3842.58	3945.36	4050.72	4158.82	4269.84	4383.98	4501.45	4622.50	47
48	3645.75	3743.87	3844.27	3947.10	4052.50	4160.65	4271.72	4385.91	4503.44	4624.55	48
49	3647.36	3745.52	3845.96	3948.83	4054.28	4162.47	4273.59	4387.84	4505.43	4626.60	49
50	3648.98	3747.18	3847.66	3950.57	4056.06	4164.30	4275.47	4389.77	4507.42	4628.65	50
51	3650.60	3748.83	3849.35	3952.31	4057.84	4166.13	4277.35	4391.70	4509.41	4630.71	51
52	3652.22	3750.49	3851.05	3954.04	4059.62	4167.96	4279.23	4393.64	4511.40	4632.76	52
53	3653.84	3752.15	3852.75	3955.78	4061.41	4169.79	4281.11	4395.57	4513.39	4634.81	53
54	3655.46	3753.80	3854.44	3957.52	4063.19	4171.62	4282.99	4397.51	4515.39	4636.87	54
55	3657.08	3755.46	3856.14	3959.26	4064.97	4173.45	4284.87	4399.44	4517.38	4638.93	55
56	3658.70	3757.12	3857.84	3961.00	4066.76	4175.28	4286.76	4401.38	4519.38	4640.98	56
57	3660.32	3758.78	3859.54	3962.74	4068.54	4177.12	4288.64	4403.32	4521.37	4643.04	57
58	3661.95	3760.44	3861.24	3964.48	4070.33	4178.95	4290.53	4405.26	4523.37	4645.10	58
59	3663.57	3762.10	3862.94	3966.22	4072.12	4180.78	4292.41	4407.20	4525.37	4647.16	59
60	3665.19	3763.76	3864.64	3967.97	4073.90	4182.62	4294.30	4409.14	4527.37	4649.23	60
Lat.	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	

Meridional Parts.

(y)

Lat.	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	
0'	4649.23	4774.98	4904.94	5039.42	5178.81	5323.51	5474.01	5650.82	5794.56	5965.92	0'
1	4651.29	4777.11	4907.14	5041.70	5181.18	5325.97	5476.57	5633.49	5797.35	5968.84	1
2	4653.35	4779.25	4909.35	5043.99	5183.54	5328.43	5479.13	5636.16	5800.14	5971.77	2
3	4655.42	4781.38	4911.55	5046.27	5185.91	5330.90	5481.69	5638.84	5802.94	5974.70	3
4	4657.49	4783.51	4913.76	5048.56	5188.29	5333.36	5484.26	5641.51	5805.74	5977.63	4
5	4659.55	4785.65	4915.97	5050.85	5190.66	5335.83	5486.83	5644.19	5808.54	5980.57	5
6	4661.62	4787.79	4918.18	5053.14	5193.03	5338.30	5489.40	5646.87	5811.34	5983.50	6
7	4663.69	4789.92	4920.39	5055.43	5195.41	5340.77	5491.97	5649.56	5814.15	5986.44	7
8	4665.76	4792.06	4922.60	5057.72	5197.79	5343.24	5494.54	5652.24	5816.95	5989.38	8
9	4667.83	4794.20	4924.81	5060.01	5200.17	5345.71	5497.11	5654.93	5819.76	5992.33	9
10	4669.91	4796.34	4927.03	5062.30	5202.55	5348.18	5499.69	5657.61	5822.57	5995.27	10
11	4671.98	4798.49	4929.24	5064.60	5204.93	5350.66	5502.27	5660.30	5825.39	5998.22	11
12	4674.06	4800.63	4931.46	5066.90	5207.31	5353.14	5504.85	5663.00	5828.20	6001.17	12
13	4676.13	4802.77	4933.68	5069.19	5209.70	5355.61	5507.43	5665.69	5831.02	6004.13	13
14	4678.21	4804.92	4935.90	5071.49	5212.08	5358.09	5510.01	5668.38	5833.84	6007.08	14
15	4680.29	4807.07	4938.12	5073.80	5214.47	5360.58	5512.60	5671.08	5836.66	6010.04	15
16	4682.37	4809.21	4940.34	5076.10	5216.86	5363.06	5515.18	5673.78	5839.48	6013.00	16
17	4684.45	4811.36	4942.57	5078.40	5219.25	5365.55	5517.77	5676.48	5842.31	6015.96	17
18	4686.53	4813.51	4944.79	5080.71	5221.64	5368.03	5520.36	5679.19	5845.13	6018.93	18
19	4688.61	4815.67	4947.02	5083.01	5224.04	5370.52	5522.95	5681.89	5847.96	6021.90	19
20	4690.70	4817.82	4949.24	5085.32	5226.43	5373.01	5525.55	5684.60	5850.79	6024.87	20
21	4692.78	4819.97	4951.47	5087.63	5228.83	5375.50	5528.14	5687.31	5853.63	6027.84	21
22	4694.87	4822.13	4953.70	5089.94	5231.23	5378.00	5530.74	5690.02	5856.47	6030.81	22
23	4696.96	4824.29	4955.94	5092.25	5233.63	5380.49	5533.34	5692.73	5859.31	6033.79	23
24	4699.05	4826.44	4958.17	5094.57	5236.03	5382.99	5535.94	5695.45	5862.15	6036.77	24
25	4701.14	4828.60	4960.40	5096.88	5238.43	5385.49	5538.55	5698.17	5864.99	6039.75	25
26	4703.23	4830.76	4962.64	5099.20	5240.84	5387.99	5541.15	5700.89	5867.84	6042.74	26
27	4705.32	4832.93	4964.88	5101.52	5243.24	5390.49	5543.76	5703.61	5870.69	6045.73	27
28	4707.41	4835.09	4967.11	5103.84	5245.65	5392.99	5546.37	5706.33	5873.54	6048.72	28
29	4709.51	4837.25	4969.35	5106.16	5248.06	5395.50	5548.98	5709.06	5876.39	6051.71	29
30	4711.60	4839.42	4971.59	5108.48	5250.47	5398.01	5551.59	5711.78	5879.24	6054.70	30
31	4713.70	4841.58	4973.83	5110.80	5252.88	5400.52	5554.20	5714.51	5882.10	6057.70	31
32	4715.79	4843.75	4976.08	5113.13	5255.30	5403.03	5556.82	5717.25	5884.96	6060.70	32
33	4717.89	4845.92	4978.32	5115.45	5257.71	5405.54	5559.44	5719.98	5887.82	6063.71	33
34	4719.99	4848.09	4980.57	5117.78	5260.13	5408.05	5562.06	5722.71	5890.68	6066.71	34
35	4722.09	4850.26	4982.82	5120.11	5262.55	5410.57	5564.68	5725.45	5893.55	6069.71	35
36	4724.19	4852.43	4985.06	5122.44	5264.97	5413.08	5567.30	5728.19	5896.41	6072.72	36
37	4726.30	4854.61	4987.31	5124.77	5267.39	5415.60	5569.93	5730.93	5899.28	6075.73	37
38	4728.40	4856.78	4989.56	5127.11	5269.81	5418.12	5572.55	5733.68	5902.15	6078.75	38
39	4730.51	4858.96	4991.82	5129.44	5272.23	5420.64	5575.18	5736.42	5905.03	6081.76	39
40	4732.61	4861.13	4994.07	5131.78	5274.66	5423.17	5577.81	5739.17	5907.90	6084.78	40
41	4734.72	4863.31	4996.32	5134.11	5277.09	5425.69	5580.44	5741.92	5910.78	6087.81	41
42	4736.83	4865.49	4998.58	5136.45	5279.52	5428.22	5583.08	5744.67	5913.67	6090.83	42
43	4738.94	4867.67	5000.84	5138.79	5281.95	5430.75	5585.71	5747.43	5916.55	6093.86	43
44	4741.05	4869.86	5003.10	5141.14	5284.38	5433.28	5588.35	5750.18	5919.44	6096.89	44
45	4743.16	4872.04	5005.36	5143.48	5286.82	5435.81	5590.99	5752.94	5922.33	6099.92	45
46	4745.28	4874.22	5007.62	5145.83	5289.25	5438.35	5593.64	5755.70	5925.22	6102.95	46
47	4747.39	4876.41	5009.88	5148.17	5291.69	5440.88	5596.28	5758.46	5928.11	6105.99	47
48	4749.51	4878.60	5012.15	5150.52	5294.13	5443.42	5598.93	5761.23	5931.00	6109.03	48
49	4751.63	4880.79	5014.41	5152.87	5296.57	5445.96	5601.57	5763.99	5933.90	6112.07	49
50	4753.74	4882.98	5016.68	5155.22	5299.01	5448.50	5604.22	5766.76	5936.80	6115.12	50
51	4755.86	4885.17	5018.94	5157.57	5301.45	5451.05	5606.87	5769.53	5939.70	6118.16	51
52	4757.98	4887.36	5021.21	5159.93	5303.90	5453.59	5609.53	5772.31	5942.61	6121.21	52
53	4760.10	4889.55	5023.48	5162.28	5306.34	5456.14	5612.18	5775.08	5945.51	6124.26	53
54	4762.23	4891.75	5025.76	5164.64	5308.79	5458.68	5614.84	5777.86	5948.42	6127.32	54
55	4764.35	4893.94	5028.03	5167.00	5311.24	5461.23	5617.50	5780.64	5951.33	6130.38	55
56	4766.47	4896.14	5030.30	5169.36	5313.69	5463.78	5620.16	5783.42	5954.24	6133.44	56
57	4768.60	4898.34	5032.58	5171.72	5316.15	5466.34	5622.82	5786.20	5957.16	6136.50	57
58	4770.73	4900.54	5034.86	5174.08	5318.60	5468.89	5625.49	5788.98	5960.08	6139.56	58
59	4772.86	4902.74	5037.14	5176.44	5321.06	5471.45	5628.15	5791.77	5963.00	6142.63	59
60	4774.98	4904.94	5039.42	5178.81	5323.51	5474.01	5630.82	5794.56	5965.92	6145.70	60
Lat.	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	

Meridional Parts.

(v)

Lat.	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	
0'	6145.70	6334.84	6534.42	6745.74	6970.34	7210.07	7467.21	7744.57	8045.71	8375.20	0'
1	6148.77	6338.08	6537.85	6749.37	6974.20	7214.20	7471.66	7749.38	8050.95	8380.96	1
2	6151.85	6341.32	6541.27	6753.01	6978.07	7218.35	7476.11	7754.20	8056.20	8386.73	2
3	6154.93	6344.56	6544.70	6756.64	6981.95	7222.49	7480.57	7759.02	8061.46	8392.52	3
4	6158.01	6347.81	6548.13	6760.28	6985.83	7226.64	7485.03	7763.86	8066.73	8398.31	4
5	6161.09	6351.06	6551.57	6763.93	6989.71	7230.80	7489.50	7768.70	8072.01	8404.11	5
6	6164.18	6354.31	6555.01	6767.58	6993.60	7234.96	7493.98	7773.55	8077.29	8409.92	6
7	6167.27	6357.56	6558.45	6771.23	6997.49	7239.12	7498.46	7778.40	8082.58	8415.74	7
8	6170.36	6360.82	6561.89	6774.89	7001.38	7243.29	7502.95	7783.26	8087.88	8421.57	8
9	6173.45	6364.08	6565.34	6778.55	7005.28	7247.47	7507.44	7788.12	8093.19	8427.42	9
10	6176.55	6367.35	6568.79	6782.21	7009.19	7251.65	7511.94	7793.00	8098.51	8433.27	10
11	6179.65	6370.61	6572.25	6785.88	7013.10	7255.83	7516.45	7797.88	8103.83	8439.13	11
12	6182.75	6373.88	6575.70	6789.55	7017.01	7260.02	7520.96	7802.76	8109.17	8445.00	12
13	6185.85	6377.16	6579.16	6793.22	7020.93	7264.22	7525.47	7807.66	8114.51	8450.88	13
14	6188.96	6380.43	6582.63	6796.90	7024.85	7268.42	7530.00	7812.56	8119.86	8456.77	14
15	6192.07	6383.71	6586.10	6800.58	7028.77	7272.62	7534.53	7817.46	8125.22	8462.67	15
16	6195.18	6386.99	6589.57	6804.27	7032.70	7276.83	7539.06	7822.33	8130.58	8468.58	16
17	6198.30	6390.28	6593.05	6807.96	7036.64	7281.05	7543.60	7827.30	8135.95	8474.50	17
18	6201.42	6393.57	6596.52	6811.65	7040.58	7285.27	7548.15	7832.23	8141.33	8480.43	18
19	6204.54	6396.86	6600.01	6815.35	7044.52	7289.49	7552.70	7837.16	8146.72	8486.37	19
20	6207.66	6400.15	6603.49	6819.05	7048.47	7293.72	7557.26	7842.10	8152.12	8492.32	20
21	6210.78	6403.44	6606.98	6822.75	7052.42	7297.96	7561.82	7847.05	8157.53	8498.28	21
22	6213.91	6406.74	6610.47	6826.46	7056.37	7302.20	7566.39	7852.01	8162.95	8504.25	22
23	6217.04	6410.05	6613.96	6830.18	7060.33	7306.44	7570.96	7856.97	8168.37	8510.23	23
24	6220.18	6413.35	6617.46	6833.89	7064.30	7310.69	7575.54	7861.94	8173.80	8516.22	24
25	6223.31	6416.66	6620.97	6837.61	7068.27	7314.95	7580.13	7866.91	8179.24	8522.22	25
26	6226.45	6419.97	6624.47	6841.34	7072.24	7319.21	7584.72	7871.90	8184.69	8528.23	26
27	6229.59	6423.29	6627.98	6845.07	7076.22	7323.47	7589.32	7876.89	8190.15	8534.26	27
28	6232.74	6426.61	6631.49	6848.80	7080.20	7327.74	7593.93	7881.89	8195.61	8540.29	28
29	6235.89	6429.93	6635.01	6852.53	7084.19	7332.02	7598.54	7886.89	8201.09	8546.33	29
30	6239.04	6433.25	6638.53	6856.27	7088.18	7336.30	7603.16	7891.91	8206.57	8552.38	30
31	6242.19	6436.58	6642.05	6860.02	7092.18	7340.55	7607.78	7896.93	8212.06	8558.45	31
32	6245.35	6439.91	6645.58	6863.77	7096.18	7344.83	7612.41	7901.95	8217.56	8564.52	32
33	6248.50	6443.24	6649.11	6867.52	7100.18	7349.18	7617.04	7906.98	8223.07	8570.61	33
34	6251.67	6446.58	6652.64	6871.27	7104.19	7353.48	7621.68	7912.03	8228.59	8576.70	34
35	6254.83	6449.92	6656.18	6875.03	7108.21	7357.79	7626.33	7917.08	8234.12	8582.81	35
36	6258.00	6453.26	6659.72	6878.80	7112.23	7362.10	7630.99	7922.13	8239.66	8588.93	36
37	6261.17	6456.61	6663.26	6882.56	7116.25	7366.42	7635.65	7927.19	8245.20	8595.06	37
38	6264.34	6459.95	6666.81	6886.34	7120.28	7370.74	7640.31	7932.26	8250.75	8601.20	38
39	6267.51	6463.31	6670.36	6890.11	7124.31	7375.07	7644.98	7937.34	8256.31	8607.35	39
40	6270.69	6466.66	6673.91	6893.89	7128.35	7379.40	7649.66	7942.43	8261.88	8613.51	40
41	6273.87	6470.02	6677.47	6897.68	7132.39	7383.74	7654.35	7947.52	8267.46	8619.68	41
42	6277.05	6473.38	6681.03	6901.46	7136.43	7388.08	7659.04	7952.62	8273.05	8625.86	42
43	6280.24	6476.74	6684.59	6905.25	7140.48	7392.43	7663.74	7957.72	8278.65	8632.05	43
44	6283.43	6480.11	6688.16	6909.05	7144.54	7396.79	7668.44	7962.84	8284.25	8638.26	44
45	6286.62	6483.48	6691.73	6912.85	7148.60	7401.15	7673.15	7967.96	8289.87	8644.47	45
46	6289.82	6486.86	6695.31	6916.65	7152.67	7405.51	7677.87	7973.09	8295.49	8650.70	46
47	6293.01	6490.23	6698.89	6920.46	7156.74	7409.88	7682.59	7978.23	8301.12	8656.94	47
48	6296.21	6493.61	6702.47	6924.27	7160.81	7414.26	7687.32	7983.37	8306.77	8663.19	48
49	6299.42	6497.00	6706.06	6928.09	7164.89	7418.64	7692.05	7988.52	8312.42	8669.45	49
50	6302.62	6500.38	6709.65	6931.91	7168.97	7423.03	7696.79	7993.68	8318.08	8675.72	50
51	6305.83	6503.77	6713.24	6935.73	7173.06	7427.42	7701.54	7998.85	8323.75	8682.00	51
52	6309.04	6507.17	6716.84	6939.56	7177.15	7431.82	7706.30	8004.03	8329.43	8688.29	52
53	6312.26	6510.56	6720.44	6943.40	7181.25	7436.22	7711.06	8009.21	8335.12	8694.60	53
54	6315.48	6513.96	6724.04	6947.23	7185.35	7440.63	7715.83	8014.40	8340.82	8700.92	54
55	6318.70	6517.36	6727.65	6951.07	7189.46	7445.05	7720.60	8019.60	8346.52	8707.25	55
56	6321.92	6520.77	6731.26	6954.92	7193.57	7449.47	7725.38	8024.81	8352.24	8713.59	56
57	6325.14	6524.18	6734.88	6958.77	7197.69	7453.89	7730.17	8030.02	8357.96	8719.94	57
58	6328.37	6527.59	6738.50	6962.62	7201.81	7458.33	7734.96	8035.24	8363.70	8726.30	58
59	6331.61	6531.01	6742.12	6966.48	7205.94	7462.76	7739.76	8040.47	8369.44	8732.68	59
60	6334.84	6534.42	6745.74	6970.34	7210.07	7467.21	7744.57	8045.71	8375.20	8739.06	60
Lat.	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	

Meridional Parts.

(y)

Lat.	81°	82°	83°	84°	85°	86°	87°	88°	89°	
0	8739.06	9145.46	9605.82	10136.89	10764.62	11532.52	12522.11	13916.43	16299.56	0
1	8745.46	9152.65	9614.03	10146.46	10776.11	11546.88	12541.27	13945.20	16357.34	1
2	8751.87	9159.86	9622.27	10156.07	10787.65	11561.31	12560.54	13974.22	16416.11	2
3	8758.29	9167.08	9630.52	10165.70	10799.22	11575.80	12579.91	14003.48	16475.90	3
4	8764.73	9174.32	9638.80	10175.37	10810.82	11590.34	12599.40	14033.00	16536.76	4
5	8771.17	9181.57	9647.09	10185.05	10822.47	11604.95	12619.00	14062.77	16598.69	5
6	8777.63	9188.84	9655.40	10194.77	10834.16	11619.62	12638.70	14092.80	16661.78	6
7	8784.10	9196.13	9663.74	10204.51	10845.89	11634.36	12658.53	14123.09	16726.04	7
8	8790.58	9203.42	9672.09	10214.28	10857.65	11649.16	12678.46	14153.66	16791.53	8
9	8797.08	9210.74	9680.47	10224.08	10869.46	11664.02	12698.52	14184.49	16858.29	9
10	8803.58	9218.07	9688.86	10233.90	10881.31	11678.94	12718.69	14215.61	16926.36	10
11	8810.10	9225.41	9697.28	10243.75	10893.20	11693.93	12738.98	14247.01	16995.81	11
12	8816.63	9232.77	9705.71	10253.64	10905.13	11708.99	12759.39	14278.70	17066.70	12
13	8823.17	9240.15	9714.17	10263.54	10917.10	11724.11	12779.92	14310.68	17139.09	13
14	8829.73	9247.54	9722.64	10273.48	10929.11	11739.30	12800.58	14342.97	17213.03	14
15	8836.30	9254.95	9731.14	10283.45	10941.17	11754.56	12821.36	14375.56	17288.57	15
16	8842.88	9262.37	9739.66	10293.45	10953.26	11769.88	12842.26	14408.46	17365.83	16
17	8849.47	9269.81	9748.20	10303.47	10965.40	11785.27	12863.30	14441.68	17444.87	17
18	8856.07	9277.27	9756.76	10313.53	10977.59	11800.73	12884.46	14475.23	17525.77	18
19	8862.69	9284.74	9765.34	10323.61	10989.81	11816.26	12905.75	14509.10	17608.63	19
20	8869.32	9292.23	9773.94	10333.72	11002.08	11831.87	12927.18	14543.31	17693.49	20
21	8875.96	9299.73	9782.57	10343.86	11014.40	11847.54	12948.74	14577.87	17780.53	21
22	8882.62	9307.25	9791.21	10354.03	11026.75	11863.28	12970.44	14612.78	17869.83	22
23	8889.29	9314.79	9799.88	10364.24	11039.15	11879.10	12992.27	14648.04	17961.51	23
24	8895.97	9322.34	9808.57	10374.47	11051.60	11894.99	13014.25	14683.67	18055.70	24
25	8902.66	9329.91	9817.28	10384.73	11064.39	11910.95	13036.36	14719.67	18152.55	25
26	8909.37	9337.49	9826.02	10395.03	11076.63	11926.99	13058.62	14756.05	18252.20	26
27	8916.09	9345.10	9834.77	10405.35	11089.21	11943.10	13081.02	14792.83	18354.83	27
28	8922.82	9352.72	9843.55	10415.71	11101.84	11959.29	13103.58	14830.00	18460.62	28
29	8929.57	9360.35	9852.35	10426.09	11114.52	11975.55	13126.27	14867.57	18569.76	29
30	8936.33	9368.00	9861.17	10436.51	11127.24	11991.89	13149.12	14905.56	18682.49	30
31	8943.10	9375.67	9870.02	10446.96	11140.01	12008.31	13172.13	14943.98	18799.03	31
32	8949.88	9383.36	9878.88	10457.44	11152.82	12024.81	13195.28	14982.83	18919.67	32
33	8956.68	9391.06	9887.77	10467.95	11165.69	12041.39	13218.60	15022.12	19044.69	33
34	8963.49	9398.79	9896.69	10478.50	11178.60	12058.05	13242.07	15061.87	19174.44	34
35	8970.32	9406.53	9905.63	10489.08	11191.56	12074.79	13265.70	15102.08	19309.27	35
36	8977.16	9414.28	9914.59	10499.69	11204.57	12091.60	13289.50	15142.77	19449.61	36
37	8984.01	9422.05	9923.57	10510.33	11217.63	12108.51	13313.47	15183.94	19595.92	37
38	8990.87	9429.84	9932.57	10521.01	11230.74	12125.49	13337.60	15225.62	19748.73	38
39	8997.75	9437.65	9941.60	10531.71	11243.90	12142.57	13361.90	15267.80	19908.66	39
40	9004.65	9445.48	9950.66	10542.45	11257.11	12159.72	13386.37	15310.51	20076.39	40
41	9011.55	9453.32	9959.73	10553.23	11270.37	12176.96	13411.02	15353.76	20252.72	41
42	9018.47	9461.18	9968.83	10564.04	11283.68	12194.29	13435.85	15397.56	20438.59	42
43	9025.41	9469.06	9977.96	10574.88	11297.04	12211.71	13460.86	15441.92	20635.09	43
44	9032.36	9476.96	9987.11	10585.85	11310.46	12229.21	13486.05	15486.86	20843.50	44
45	9039.32	9484.87	9996.28	10596.67	11323.93	12246.81	13511.43	15532.40	21065.37	45
46	9046.29	9492.81	10005.48	10607.62	11337.45	12264.49	13537.00	15578.55	21302.55	46
47	9053.28	9500.76	10014.70	10618.60	11351.02	12282.26	13562.75	15625.32	21557.31	47
48	9060.29	9508.73	10023.95	10629.61	11364.65	12300.13	13588.71	15672.75	21832.48	48
49	9067.31	9516.71	10033.22	10640.67	11378.33	12318.09	13614.85	15720.83	22131.60	49
50	9074.34	9524.72	10042.52	10651.75	11392.06	12336.15	13641.20	15769.59	22459.26	50
51	9081.39	9532.74	10051.84	10662.87	11405.85	12354.30	13667.75	15819.06	22821.46	51
52	9088.45	9540.79	10061.19	10674.03	11419.70	12372.54	13694.92	15869.25	23226.39	52
53	9095.52	9548.85	10070.56	10685.22	11433.60	12390.89	13721.48	15920.19	23665.42	53
54	9102.61	9556.93	10079.96	10696.46	11447.56	12409.33	13748.67	15971.89	24215.35	54
55	9109.72	9565.03	10089.38	10707.72	11461.58	12427.87	13776.07	16024.38	24842.12	55
56	9116.84	9573.15	10098.83	10719.03	11475.65	12446.51	13803.68	16077.68	25609.23	56
57	9123.97	9581.29	10108.30	10730.37	11489.78	12465.26	13831.53	16131.82	26598.21	57
58	9131.12	9589.45	10117.81	10741.75	11503.97	12484.10	13859.60	16186.83	27992.10	58
59	9138.28	9597.62	10127.33	10753.17	11518.21	12503.05	13887.90	16242.74	30374.96	59
60	9145.46	9605.82	10136.89	10764.62	11532.52	12522.11	13916.43	16299.56	Inf.	60
Lat.	81°	82°	83°	84°	85°	86°	87°	88°	89°	

(z) Bearing Amplitude and Time Amplitude at Rising and Setting of the Sun.

Declination.

Lat.	1°		2°		3°		4°		5°		6°	
	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearg. Ampl.	Time Ampl.	Bearg. Ampl.	Time Ampl.	Bearg. Ampl.	Time Ampl.	Bearg. Ampl.	Time Ampl.
°	°	h. m.	°	h. m.	°	h. m.	°	h. m.	°	h. m.	°	h. m.
1	1. 0	0. 0	2. 0	0. 0	3. 0	0. 0	4. 0	0. 0	5. 0	0. 0	6. 0	0. 0
2	1. 0	0. 0	2. 0	0. 0	3. 0	0. 0	4. 0	0. 1	5. 0	0. 1	6. 0	0. 1
3	1. 0	0. 0	2. 0	0. 0	3. 0	0. 1	4. 0	0. 1	5. 0	0. 1	6. 0	0. 1
4	1. 0	0. 0	2. 0	0. 1	3. 0	0. 1	4. 1	0. 1	5. 1	0. 1	6. 1	0. 2
5	1. 0	0. 0	2. 0	0. 1	3. 0	0. 1	4. 1	0. 1	5. 1	0. 2	6. 1	0. 2
6	1. 0	0. 0	2. 0	0. 1	3. 1	0. 1	4. 1	0. 2	5. 1	0. 2	6. 2	0. 3
7	1. 0	0. 0	2. 1	0. 1	3. 1	0. 1	4. 2	0. 2	5. 2	0. 2	6. 3	0. 3
8	1. 0	0. 1	2. 1	0. 1	3. 2	0. 2	4. 3	0. 2	5. 3	0. 3	6. 4	0. 3
9	1. 0	0. 1	2. 1	0. 1	3. 2	0. 2	4. 3	0. 3	5. 3	0. 3	6. 5	0. 4
10	1. 1	0. 1	2. 2	0. 1	3. 3	0. 2	4. 4	0. 3	5. 5	0. 4	6. 6	0. 4
11	1. 1	0. 1	2. 2	0. 2	3. 3	0. 2	4. 4	0. 3	5. 6	0. 4	6. 7	0. 5
12	1. 1	0. 1	2. 3	0. 2	3. 4	0. 3	4. 5	0. 3	5. 7	0. 4	6. 8	0. 5
13	1. 2	0. 1	2. 3	0. 2	3. 5	0. 3	4. 6	0. 4	5. 8	0. 5	6. 10	0. 6
14	1. 2	0. 1	2. 3	0. 2	3. 5	0. 3	4. 7	0. 4	5. 9	0. 5	6. 11	0. 6
15	1. 2	0. 1	2. 4	0. 2	3. 6	0. 3	4. 8	0. 4	5. 11	0. 5	6. 13	0. 6
16	1. 3	0. 1	2. 5	0. 2	3. 7	0. 3	4. 10	0. 5	5. 12	0. 6	6. 14	0. 7
17	1. 3	0. 1	2. 5	0. 2	3. 8	0. 4	4. 11	0. 5	5. 13	0. 6	6. 16	0. 7
18	1. 3	0. 1	2. 6	0. 3	3. 9	0. 4	4. 12	0. 5	5. 15	0. 7	6. 19	0. 8
19	1. 3	0. 1	2. 7	0. 3	3. 10	0. 4	4. 14	0. 6	5. 17	0. 7	6. 21	0. 8
20	1. 4	0. 1	2. 8	0. 3	3. 12	0. 4	4. 16	0. 6	5. 19	0. 7	6. 23	0. 9
21	1. 4	0. 2	2. 9	0. 3	3. 13	0. 5	4. 17	0. 6	5. 21	0. 8	6. 25	0. 9
22	1. 5	0. 2	2. 10	0. 3	3. 14	0. 5	4. 19	0. 6	5. 24	0. 8	6. 28	0. 10
23	1. 5	0. 2	2. 11	0. 3	3. 15	0. 5	4. 21	0. 7	5. 26	0. 9	6. 31	0. 10
24	1. 6	0. 2	2. 12	0. 4	3. 17	0. 5	4. 23	0. 7	5. 29	0. 9	6. 34	0. 11
25	1. 6	0. 2	2. 13	0. 4	3. 19	0. 6	4. 25	0. 7	5. 31	0. 9	6. 37	0. 11
26	1. 7	0. 2	2. 14	0. 4	3. 21	0. 6	4. 27	0. 8	5. 34	0. 10	6. 41	0. 12
27	1. 7	0. 2	2. 15	0. 4	3. 22	0. 6	4. 29	0. 8	5. 37	0. 10	6. 44	0. 12
28	1. 8	0. 2	2. 16	0. 4	3. 24	0. 6	4. 32	0. 9	5. 40	0. 11	6. 48	0. 13
29	1. 9	0. 2	2. 17	0. 4	3. 26	0. 7	4. 34	0. 9	5. 43	0. 11	6. 52	0. 13
30	1. 10	0. 2	2. 19	0. 5	3. 28	0. 7	4. 37	0. 9	5. 47	0. 12	6. 56	0. 14
31	1. 10	0. 2	2. 20	0. 5	3. 30	0. 7	4. 40	0. 10	5. 50	0. 12	7. 0	0. 14
32	1. 11	0. 2	2. 22	0. 5	3. 33	0. 7	4. 43	0. 10	5. 54	0. 13	7. 5	0. 15
33	1. 11	0. 3	2. 23	0. 5	3. 35	0. 8	4. 46	0. 10	5. 58	0. 13	7. 10	0. 16
34	1. 12	0. 3	2. 25	0. 5	3. 37	0. 8	4. 50	0. 11	6. 2	0. 14	7. 15	0. 16
35	1. 13	0. 3	2. 27	0. 6	3. 40	0. 8	4. 53	0. 11	6. 6	0. 14	7. 20	0. 17
36	1. 14	0. 3	2. 28	0. 6	3. 43	0. 9	4. 57	0. 12	6. 11	0. 15	7. 25	0. 18
37	1. 15	0. 3	2. 30	0. 6	3. 45	0. 9	5. 1	0. 12	6. 16	0. 15	7. 31	0. 18
38	1. 16	0. 3	2. 32	0. 6	3. 48	0. 9	5. 5	0. 13	6. 21	0. 16	7. 37	0. 19
39	1. 17	0. 3	2. 34	0. 6	3. 52	0. 10	5. 9	0. 13	6. 26	0. 16	7. 44	0. 20
40	1. 18	0. 3	2. 37	0. 7	3. 55	0. 10	5. 14	0. 13	6. 32	0. 17	7. 51	0. 20
41	1. 19	0. 3	2. 39	0. 7	3. 59	0. 10	5. 18	0. 14	6. 38	0. 17	7. 58	0. 21
42	1. 21	0. 4	2. 41	0. 7	4. 2	0. 11	5. 23	0. 14	6. 44	0. 18	8. 5	0. 22
43	1. 22	0. 4	2. 44	0. 7	4. 6	0. 11	5. 28	0. 15	6. 51	0. 19	8. 13	0. 22
44	1. 23	0. 4	2. 47	0. 8	4. 10	0. 12	5. 34	0. 15	6. 58	0. 19	8. 21	0. 23
45	1. 25	0. 4	2. 50	0. 8	4. 15	0. 12	5. 40	0. 16	7. 5	0. 20	8. 30	0. 24
46	1. 26	0. 4	2. 53	0. 8	4. 19	0. 12	5. 46	0. 17	7. 12	0. 21	8. 39	0. 25
47	1. 28	0. 4	2. 56	0. 9	4. 24	0. 13	5. 52	0. 17	7. 21	0. 22	8. 49	0. 26
48	1. 30	0. 4	2. 59	0. 9	4. 29	0. 13	5. 59	0. 18	7. 29	0. 22	8. 59	0. 27
49	1. 31	0. 5	3. 3	0. 9	4. 35	0. 14	6. 6	0. 18	7. 38	0. 23	9. 10	0. 28
50	1. 33	0. 5	3. 7	0. 10	4. 40	0. 14	6. 14	0. 19	7. 48	0. 24	9. 21	0. 29
51	1. 35	0. 5	3. 11	0. 10	4. 46	0. 15	6. 22	0. 20	7. 58	0. 25	9. 34	0. 30
52	1. 37	0. 5	3. 15	0. 10	4. 52	0. 15	6. 30	0. 21	8. 8	0. 26	9. 46	0. 31
53	1. 39	0. 5	3. 20	0. 11	4. 59	0. 16	6. 40	0. 21	8. 20	0. 27	10. 0	0. 32
54	1. 42	0. 5	3. 24	0. 11	5. 7	0. 16	6. 49	0. 22	8. 32	0. 28	10. 15	0. 33
55	1. 45	0. 6	3. 29	0. 11	5. 14	0. 17	6. 59	0. 23	8. 44	0. 29	10. 30	0. 35
56	1. 47	0. 6	3. 35	0. 12	5. 22	0. 18	7. 10	0. 24	8. 58	0. 30	10. 46	0. 36
57	1. 50	0. 6	3. 41	0. 12	5. 31	0. 19	7. 22	0. 25	9. 13	0. 31	11. 4	0. 37
58	1. 53	0. 6	3. 47	0. 13	5. 40	0. 19	7. 34	0. 26	9. 28	0. 32	11. 22	0. 39
59	1. 57	0. 7	3. 53	0. 13	5. 50	0. 20	7. 47	0. 27	9. 45	0. 33	11. 43	0. 40
60	2. 0	0. 7	4. 0	0. 14	6. 0	0. 21	8. 1	0. 28	10. 2	0. 35	12. 4	0. 42
61	2. 4	0. 7	4. 8	0. 14	6. 12	0. 22	8. 16	0. 29	10. 21	0. 36	12. 27	0. 44
62	2. 8	0. 8	4. 16	0. 15	6. 24	0. 23	8. 33	0. 30	10. 42	0. 38	12. 52	0. 46
63	2. 12	0. 8	4. 25	0. 16	6. 37	0. 24	8. 50	0. 32	11. 4	0. 40	13. 19	0. 48
64	2. 17	0. 8	4. 34	0. 16	6. 51	0. 25	9. 9	0. 33	11. 28	0. 41	13. 48	0. 50

Bearing Amplitude and Time Amplitude at Rising and Setting of the Sun. (z)

Declination.												
Lat.	7°		8°		9°		10°		11°		12°	
	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bear ^s . Ampl.	Time Ampl.	Bear ^s . Ampl.	Time Ampl.	Bear ^s . Ampl.	Time Ampl.	Bear ^s . Ampl.	Time Ampl.
°	°	h. m.	°	h. m.	°	h. m.	°	h. m.	°	h. m.	°	h. m.
1	7. 0	0. 0	8. 0	0. 1	9. 0	0. 1	10. 0	0. 1	11. 0	0. 1	12. 0	0. 1
2	7. 0	0. 1	8. 0	0. 1	9. 0	0. 1	10. 0	0. 1	11. 0	0. 2	12. 0	0. 2
3	7. 1	0. 1	8. 1	0. 2	9. 1	0. 2	10. 1	0. 2	11. 1	0. 2	12. 1	0. 3
4	7. 1	0. 2	8. 1	0. 2	9. 1	0. 3	10. 2	0. 3	11. 2	0. 3	12. 2	0. 3
5	7. 2	0. 2	8. 2	0. 3	9. 2	0. 3	10. 3	0. 4	11. 3	0. 4	12. 3	0. 4
6	7. 3	0. 3	8. 3	0. 3	9. 3	0. 4	10. 4	0. 4	11. 4	0. 5	12. 4	0. 5
7	7. 4	0. 3	8. 4	0. 4	9. 4	0. 4	10. 5	0. 5	11. 5	0. 5	12. 5	0. 6
8	7. 5	0. 4	8. 5	0. 5	9. 5	0. 5	10. 6	0. 6	11. 7	0. 6	12. 7	0. 7
9	7. 5	0. 4	8. 6	0. 5	9. 7	0. 6	10. 8	0. 6	11. 8	0. 6	12. 9	0. 8
10	7. 7	0. 5	8. 8	0. 6	9. 9	0. 6	10. 10	0. 7	11. 11	0. 8	12. 12	0. 9
11	7. 9	0. 5	8. 9	0. 6	9. 10	0. 7	10. 12	0. 8	11. 13	0. 9	12. 14	0. 9
12	7. 10	0. 6	8. 11	0. 7	9. 12	0. 8	10. 14	0. 9	11. 15	0. 9	12. 16	0. 10
13	7. 11	0. 6	8. 12	0. 7	9. 14	0. 8	10. 15	0. 9	11. 17	0. 10	12. 19	0. 11
14	7. 13	0. 7	8. 15	0. 8	9. 17	0. 9	10. 18	0. 10	11. 20	0. 11	12. 22	0. 12
15	7. 15	0. 8	8. 17	0. 9	9. 19	0. 10	10. 21	0. 11	11. 23	0. 12	12. 25	0. 13
16	7. 17	0. 8	8. 19	0. 9	9. 22	0. 10	10. 24	0. 12	11. 27	0. 13	12. 29	0. 14
17	7. 19	0. 9	8. 22	0. 10	9. 25	0. 11	10. 27	0. 12	11. 30	0. 14	12. 33	0. 15
18	7. 22	0. 9	8. 25	0. 10	9. 28	0. 12	10. 30	0. 13	11. 34	0. 14	12. 38	0. 16
19	7. 24	0. 10	8. 28	0. 11	9. 31	0. 12	10. 34	0. 14	11. 38	0. 15	12. 42	0. 17
20	7. 27	0. 10	8. 31	0. 12	9. 35	0. 13	10. 39	0. 15	11. 43	0. 16	12. 47	0. 18
21	7. 30	0. 11	8. 34	0. 12	9. 39	0. 14	10. 43	0. 16	11. 48	0. 17	12. 52	0. 19
22	7. 33	0. 11	8. 38	0. 13	9. 43	0. 15	10. 48	0. 16	11. 53	0. 18	12. 58	0. 20
23	7. 36	0. 12	8. 42	0. 14	9. 47	0. 15	10. 53	0. 17	11. 58	0. 19	13. 3	0. 21
24	7. 40	0. 13	8. 46	0. 14	9. 52	0. 16	10. 58	0. 18	12. 4	0. 20	13. 9	0. 22
25	7. 44	0. 13	8. 50	0. 15	9. 56	0. 17	11. 3	0. 19	12. 9	0. 21	13. 15	0. 23
26	7. 48	0. 14	8. 55	0. 16	10. 1	0. 18	11. 9	0. 20	12. 15	0. 22	13. 22	0. 24
27	7. 52	0. 14	8. 59	0. 16	10. 6	0. 19	11. 15	0. 21	12. 22	0. 23	13. 29	0. 25
28	7. 56	0. 15	9. 4	0. 17	10. 12	0. 19	11. 21	0. 22	12. 29	0. 24	13. 37	0. 26
29	8. 0	0. 16	9. 9	0. 18	10. 18	0. 20	11. 27	0. 22	12. 36	0. 25	13. 45	0. 27
30	8. 5	0. 16	9. 15	0. 19	10. 24	0. 21	11. 34	0. 23	12. 44	0. 26	13. 53	0. 28
31	8. 10	0. 17	9. 21	0. 19	10. 31	0. 22	11. 41	0. 24	12. 52	0. 27	14. 2	0. 29
32	8. 16	0. 18	9. 27	0. 20	10. 38	0. 23	11. 49	0. 25	13. 0	0. 28	14. 11	0. 31
33	8. 21	0. 18	9. 33	0. 21	10. 45	0. 24	11. 57	0. 26	13. 9	0. 29	14. 21	0. 32
34	8. 27	0. 19	9. 40	0. 22	10. 52	0. 25	12. 5	0. 27	13. 18	0. 30	14. 32	0. 33
35	8. 33	0. 20	9. 47	0. 23	11. 0	0. 25	12. 14	0. 28	13. 28	0. 31	14. 43	0. 34
36	8. 40	0. 20	9. 54	0. 23	11. 9	0. 26	12. 24	0. 29	13. 39	0. 32	14. 54	0. 36
37	8. 47	0. 21	10. 2	0. 24	11. 18	0. 27	12. 34	0. 31	13. 49	0. 34	15. 6	0. 37
38	8. 54	0. 22	10. 11	0. 25	11. 27	0. 28	12. 44	0. 32	14. 1	0. 35	15. 18	0. 38
39	9. 1	0. 23	10. 19	0. 26	11. 37	0. 29	12. 55	0. 33	14. 13	0. 36	15. 31	0. 40
40	9. 9	0. 24	10. 28	0. 27	11. 47	0. 31	13. 6	0. 34	14. 25	0. 38	15. 45	0. 41
41	9. 18	0. 25	10. 38	0. 28	11. 58	0. 32	13. 18	0. 35	14. 39	0. 39	16. 0	0. 43
42	9. 26	0. 25	10. 48	0. 29	12. 9	0. 33	13. 31	0. 37	14. 53	0. 40	16. 15	0. 44
43	9. 35	0. 26	10. 58	0. 30	12. 21	0. 34	13. 44	0. 38	15. 7	0. 42	16. 31	0. 46
44	9. 45	0. 27	11. 9	0. 31	12. 34	0. 35	13. 58	0. 39	15. 23	0. 43	16. 48	0. 47
45	9. 55	0. 28	11. 21	0. 32	12. 47	0. 36	14. 13	0. 41	15. 39	0. 45	17. 6	0. 49
46	10. 6	0. 29	11. 33	0. 33	13. 1	0. 38	14. 29	0. 42	15. 57	0. 46	17. 25	0. 51
47	10. 18	0. 30	11. 47	0. 35	13. 16	0. 39	14. 45	0. 44	16. 15	0. 48	17. 45	0. 53
48	10. 30	0. 31	12. 1	0. 36	13. 31	0. 41	15. 3	0. 45	16. 34	0. 50	18. 6	0. 55
49	10. 42	0. 32	12. 15	0. 37	13. 48	0. 42	15. 21	0. 47	16. 55	0. 52	18. 28	0. 57
50	10. 56	0. 34	12. 30	0. 39	14. 5	0. 44	15. 40	0. 49	17. 16	0. 54	18. 52	0. 59
51	11. 10	0. 35	12. 47	0. 40	14. 24	0. 45	16. 1	0. 50	17. 39	0. 56	19. 18	1. 1
52	11. 25	0. 36	13. 4	0. 41	14. 43	0. 47	16. 23	0. 52	18. 3	0. 58	19. 44	1. 3
53	11. 41	0. 38	13. 22	0. 43	15. 4	0. 49	16. 46	0. 54	18. 29	1. 0	20. 13	1. 6
54	11. 58	0. 39	13. 42	0. 45	15. 26	0. 50	17. 11	0. 56	18. 57	1. 2	20. 43	1. 8
55	12. 16	0. 40	14. 3	0. 46	15. 50	0. 52	17. 37	0. 58	19. 26	1. 4	21. 15	1. 11
56	12. 35	0. 42	14. 25	0. 48	16. 15	0. 54	18. 6	1. 1	19. 57	1. 7	21. 50	1. 13
57	12. 56	0. 44	14. 48	0. 50	16. 42	0. 56	18. 36	1. 3	20. 31	1. 10	22. 26	1. 16
58	13. 18	0. 45	15. 13	0. 52	17. 10	0. 59	19. 8	1. 6	21. 7	1. 12	23. 6	1. 19
59	13. 41	0. 47	15. 41	0. 54	17. 41	1. 1	19. 42	1. 8	21. 44	1. 16	23. 49	1. 23
60	14. 6	0. 49	16. 10	0. 56	18. 14	1. 4	20. 19	1. 11	22. 26	1. 19	24. 34	1. 26
61	14. 34	0. 51	16. 41	0. 59	18. 49	1. 6	20. 59	1. 14	23. 11	1. 22	25. 24	1. 30
62	15. 3	0. 53	17. 15	1. 1	19. 28	1. 9	21. 43	1. 17	23. 59	1. 26	26. 17	1. 34
63	15. 34	0. 56	17. 51	1. 4	20. 9	1. 12	22. 29	1. 21	24. 51	1. 30	27. 15	1. 39
64	16. 8	0. 58	18. 31	1. 7	20. 54	1. 16	23. 20	1. 25	25. 48	1. 34	28. 19	1. 43

(z) Bearing Amplitude and Time Amplitude at Rising and Setting of the Sun.

Declination.

Lat.	13°		14°		15°		16°		17°		18°	
	Bearing A. pl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.
0	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	13. 0	0. 1	14. 0	0. 1	15. 0	0. 1	16. 0	0. 1	17. 0	0. 1	18. 0	0. 1
2	13. 0	0. 2	14. 0	0. 2	15. 0	0. 2	16. 1	0. 2	17. 1	0. 2	18. 1	0. 3
3	13. 1	0. 3	14. 1	0. 3	15. 1	0. 3	16. 1	0. 3	17. 2	0. 4	18. 2	0. 4
4	13. 2	0. 4	14. 2	0. 4	15. 2	0. 4	16. 2	0. 5	17. 3	0. 5	18. 3	0. 5
5	13. 3	0. 5	14. 3	0. 5	15. 4	0. 5	16. 4	0. 6	17. 4	0. 6	18. 4	0. 7
6	13. 4	0. 6	14. 4	0. 6	15. 5	0. 6	16. 5	0. 7	17. 5	0. 7	18. 6	0. 8
7	13. 6	0. 6	14. 6	0. 7	15. 7	0. 8	16. 7	0. 8	17. 8	0. 9	18. 8	0. 9
8	13. 8	0. 7	14. 8	0. 8	15. 9	0. 9	16. 10	0. 9	17. 10	0. 10	18. 11	0. 10
9	13. 10	0. 8	14. 10	0. 9	15. 11	0. 10	16. 12	0. 10	17. 13	0. 11	18. 14	0. 12
10	13. 13	0. 9	14. 14	0. 10	15. 15	0. 11	16. 16	0. 12	17. 17	0. 12	18. 18	0. 13
11	13. 15	0. 10	14. 16	0. 11	15. 17	0. 12	16. 18	0. 13	17. 20	0. 14	18. 21	0. 14
12	13. 18	0. 11	14. 19	0. 12	15. 21	0. 13	16. 22	0. 14	17. 23	0. 15	18. 25	0. 16
13	13. 21	0. 12	14. 22	0. 13	15. 24	0. 14	16. 26	0. 15	17. 28	0. 16	18. 30	0. 17
14	13. 24	0. 13	14. 26	0. 14	15. 28	0. 15	16. 30	0. 16	17. 32	0. 17	18. 34	0. 19
15	13. 28	0. 14	14. 30	0. 15	15. 33	0. 16	16. 35	0. 18	17. 37	0. 19	18. 40	0. 20
16	13. 32	0. 15	14. 34	0. 16	15. 37	0. 18	16. 40	0. 19	17. 43	0. 20	18. 45	0. 21
17	13. 36	0. 16	14. 39	0. 17	15. 42	0. 19	16. 45	0. 20	17. 48	0. 21	18. 51	0. 23
18	13. 41	0. 17	14. 44	0. 19	15. 47	0. 20	16. 51	0. 21	17. 54	0. 23	18. 57	0. 24
19	13. 46	0. 18	14. 50	0. 20	15. 53	0. 21	16. 57	0. 23	18. 1	0. 24	19. 5	0. 26
20	13. 51	0. 19	14. 55	0. 21	15. 59	0. 22	17. 4	0. 24	18. 8	0. 26	19. 12	0. 27
21	13. 57	0. 20	15. 1	0. 22	16. 6	0. 24	17. 11	0. 25	18. 15	0. 27	19. 20	0. 29
22	14. 3	0. 21	15. 8	0. 23	16. 13	0. 25	17. 18	0. 27	18. 23	0. 28	19. 28	0. 30
23	14. 9	0. 22	15. 15	0. 24	16. 20	0. 26	17. 26	0. 28	18. 31	0. 30	19. 37	0. 32
24	14. 16	0. 24	15. 22	0. 26	16. 28	0. 27	17. 34	0. 29	18. 40	0. 31	19. 46	0. 33
25	14. 23	0. 25	15. 29	0. 27	16. 36	0. 29	17. 43	0. 31	18. 49	0. 33	19. 56	0. 35
26	14. 30	0. 26	15. 37	0. 28	16. 45	0. 30	17. 52	0. 32	18. 59	0. 34	20. 7	0. 36
27	14. 38	0. 27	15. 45	0. 29	16. 54	0. 31	18. 1	0. 34	19. 9	0. 36	20. 18	0. 38
28	14. 46	0. 28	15. 54	0. 30	17. 3	0. 33	18. 11	0. 35	19. 20	0. 37	20. 29	0. 40
29	14. 54	0. 29	16. 3	0. 32	17. 13	0. 34	18. 22	0. 37	19. 32	0. 39	20. 41	0. 42
30	15. 3	0. 31	16. 13	0. 33	17. 23	0. 36	18. 34	0. 38	19. 44	0. 41	20. 54	0. 43
31	15. 13	0. 32	16. 23	0. 34	17. 34	0. 37	18. 46	0. 40	19. 57	0. 42	21. 8	0. 45
32	15. 23	0. 33	16. 34	0. 36	17. 46	0. 39	18. 58	0. 41	20. 10	0. 44	21. 22	0. 47
33	15. 34	0. 34	16. 46	0. 37	17. 59	0. 40	19. 11	0. 43	20. 24	0. 46	21. 37	0. 49
34	15. 45	0. 36	16. 58	0. 39	18. 12	0. 42	19. 25	0. 45	20. 38	0. 48	21. 53	0. 51
35	15. 57	0. 37	17. 11	0. 40	18. 26	0. 43	19. 40	0. 46	20. 54	0. 49	22. 10	0. 53
36	16. 9	0. 39	17. 24	0. 42	18. 40	0. 45	19. 55	0. 48	21. 11	0. 51	22. 27	0. 55
37	16. 22	0. 40	17. 38	0. 43	18. 55	0. 47	20. 11	0. 50	21. 28	0. 53	22. 46	0. 57
38	16. 35	0. 42	17. 53	0. 45	19. 10	0. 48	20. 28	0. 52	21. 47	0. 55	23. 5	0. 59
39	16. 50	0. 43	18. 8	0. 47	19. 27	0. 50	20. 46	0. 54	22. 6	0. 57	23. 26	1. 1
40	17. 5	0. 45	18. 25	0. 48	19. 45	0. 52	21. 5	0. 56	22. 26	0. 59	23. 47	1. 3
41	17. 21	0. 46	18. 42	0. 50	20. 3	0. 54	21. 25	0. 58	22. 48	1. 2	24. 10	1. 6
42	17. 37	0. 48	19. 0	0. 52	20. 23	0. 56	21. 46	1. 0	23. 10	1. 4	24. 34	1. 8
43	17. 55	0. 50	19. 19	0. 54	20. 43	0. 58	22. 8	1. 2	23. 34	1. 6	25. 0	1. 11
44	18. 13	0. 52	19. 39	0. 56	21. 5	1. 0	22. 32	1. 4	23. 59	1. 9	25. 26	1. 13
45	18. 33	0. 53	20. 0	0. 58	21. 28	1. 2	22. 57	1. 7	24. 25	1. 11	25. 55	1. 16
46	18. 54	0. 55	20. 23	1. 0	21. 53	1. 4	23. 23	1. 9	24. 53	1. 14	26. 25	1. 19
47	19. 16	0. 57	20. 47	1. 2	22. 18	1. 7	23. 50	1. 12	25. 23	1. 17	26. 57	1. 22
48	19. 39	0. 59	21. 12	1. 4	22. 45	1. 9	24. 20	1. 14	25. 54	1. 19	27. 31	1. 25
49	20. 3	1. 2	21. 38	1. 7	23. 14	1. 12	24. 51	1. 17	26. 28	1. 22	28. 6	1. 28
50	20. 29	1. 4	22. 7	1. 9	23. 45	1. 14	25. 24	1. 20	27. 3	1. 25	28. 44	1. 31
51	20. 57	1. 6	22. 37	1. 12	24. 18	1. 17	25. 59	1. 23	27. 41	1. 29	29. 25	1. 35
52	21. 26	1. 9	23. 9	1. 14	24. 52	1. 20	26. 36	1. 26	28. 21	1. 32	30. 7	1. 38
53	21. 57	1. 11	23. 43	1. 17	25. 28	1. 23	27. 16	1. 29	29. 4	1. 36	30. 54	1. 42
54	22. 30	1. 14	24. 18	1. 20	26. 7	1. 27	27. 58	1. 33	29. 50	1. 40	31. 43	1. 46
55	23. 6	1. 17	24. 57	1. 23	26. 50	1. 30	28. 43	1. 37	30. 39	1. 44	32. 36	1. 51
56	23. 43	1. 20	25. 38	1. 27	27. 34	1. 34	29. 32	1. 41	31. 32	1. 48	33. 33	1. 55
57	24. 23	1. 23	26. 22	1. 30	28. 22	1. 37	30. 24	1. 45	32. 28	1. 52	34. 34	2. 0
58	25. 7	1. 27	27. 10	1. 34	29. 14	1. 42	31. 20	1. 49	33. 29	1. 57	35. 40	2. 5
59	25. 54	1. 30	28. 1	1. 38	30. 10	1. 46	32. 21	1. 54	34. 35	2. 2	36. 52	2. 11
60	26. 44	1. 34	28. 56	1. 42	31. 10	1. 51	33. 27	1. 59	35. 47	2. 8	38. 10	2. 17
61	27. 39	1. 38	29. 56	1. 47	32. 16	1. 56	34. 39	2. 5	37. 5	2. 14	39. 36	2. 24
62	28. 38	1. 43	31. 1	1. 52	33. 27	2. 1	35. 57	2. 11	38. 31	2. 20	41. 10	2. 31
63	29. 42	1. 48	32. 12	1. 57	34. 46	2. 7	37. 23	2. 17	40. 5	2. 27	42. 54	2. 38
64	30. 52	1. 53	33. 30	2. 3	36. 11	2. 13	38. 58	2. 24	41. 50	2. 35	44. 49	2. 47

(z) Bearing Amplitude and Time Amplitude at Rising and Setting of the Sun.

Declination.

Lat.	19°		20°		21°		22°		23°		23° 30'		23° 45'	
	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.	Bearing Ampl.	Time Ampl.
°	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	19. 0	0. 1	20. 0	0. 1	21. 0	0. 2	22. 0	0. 2	23. 1	0. 1	23. 31	0. 1	23. 46	0. 2
2	19. 1	0. 3	20. 1	0. 3	21. 1	0. 3	22. 1	0. 3	23. 2	0. 3	23. 32	0. 3	23. 47	0. 4
3	19. 2	0. 4	20. 2	0. 4	21. 2	0. 5	22. 2	0. 5	23. 3	0. 5	23. 33	0. 5	23. 48	0. 6
4	19. 3	0. 6	20. 3	0. 6	21. 3	0. 6	22. 3	0. 6	23. 4	0. 7	23. 34	0. 7	23. 49	0. 8
5	19. 4	0. 7	20. 5	0. 7	21. 5	0. 8	22. 5	0. 8	23. 5	0. 9	23. 36	0. 9	23. 51	0. 10
6	19. 6	0. 8	20. 7	0. 9	21. 7	0. 9	22. 7	0. 10	23. 8	0. 10	23. 38	0. 10	23. 53	0. 11
7	19. 9	0. 10	20. 9	0. 10	21. 10	0. 11	22. 10	0. 11	23. 11	0. 12	23. 41	0. 12	23. 56	0. 13
8	19. 12	0. 11	20. 12	0. 12	21. 13	0. 12	22. 14	0. 13	23. 14	0. 14	23. 44	0. 14	23. 59	0. 15
9	19. 15	0. 12	20. 16	0. 13	21. 17	0. 14	22. 18	0. 15	23. 18	0. 15	23. 46	0. 15	24. 3	0. 16
10	19. 19	0. 14	20. 20	0. 15	21. 21	0. 16	22. 22	0. 16	23. 23	0. 17	23. 53	0. 17	24. 8	0. 18
11	19. 22	0. 15	20. 24	0. 16	21. 25	0. 17	22. 26	0. 18	23. 27	0. 19	23. 58	0. 19	24. 13	0. 20
12	19. 26	0. 17	20. 28	0. 18	21. 30	0. 19	22. 31	0. 20	23. 33	0. 21	24. 3	0. 21	24. 18	0. 22
13	19. 31	0. 18	20. 33	0. 19	21. 35	0. 20	22. 37	0. 21	23. 39	0. 22	24. 9	0. 22	24. 25	0. 23
14	19. 36	0. 20	20. 38	0. 21	21. 41	0. 22	22. 43	0. 23	23. 45	0. 24	24. 16	0. 24	24. 32	0. 25
15	19. 42	0. 21	20. 44	0. 22	21. 46	0. 24	22. 49	0. 25	23. 51	0. 26	24. 23	0. 26	24. 39	0. 27
16	19. 48	0. 23	20. 51	0. 24	21. 53	0. 25	22. 56	0. 27	23. 59	0. 28	24. 30	0. 28	24. 46	0. 29
17	19. 54	0. 24	20. 57	0. 26	22. 0	0. 27	23. 4	0. 28	24. 7	0. 30	24. 38	0. 30	24. 54	0. 31
18	20. 1	0. 26	21. 5	0. 27	22. 8	0. 29	23. 12	0. 30	24. 15	0. 32	24. 47	0. 32	25. 3	0. 33
19	20. 8	0. 27	21. 12	0. 29	22. 16	0. 30	23. 21	0. 32	24. 24	0. 34	24. 56	0. 34	25. 12	0. 35
20	20. 16	0. 29	21. 21	0. 30	22. 25	0. 32	23. 30	0. 34	24. 34	0. 36	25. 6	0. 36	25. 22	0. 37
21	20. 24	0. 30	21. 30	0. 32	22. 34	0. 34	23. 40	0. 36	24. 45	0. 38	25. 17	0. 38	25. 33	0. 39
22	20. 33	0. 32	21. 39	0. 34	22. 44	0. 36	23. 50	0. 38	24. 56	0. 40	25. 28	0. 40	25. 44	0. 41
23	20. 43	0. 34	21. 49	0. 36	22. 55	0. 37	24. 1	0. 39	25. 7	0. 42	25. 40	0. 43	25. 57	0. 43
24	20. 53	0. 35	21. 59	0. 37	23. 6	0. 39	24. 13	0. 41	25. 19	0. 44	25. 53	0. 45	26. 10	0. 45
25	21. 3	0. 37	22. 10	0. 39	23. 18	0. 41	24. 25	0. 43	25. 32	0. 46	26. 6	0. 47	26. 23	0. 47
26	21. 14	0. 39	22. 22	0. 41	23. 30	0. 43	24. 38	0. 45	25. 46	0. 48	26. 20	0. 49	26. 37	0. 49
27	21. 26	0. 40	22. 34	0. 43	23. 43	0. 45	24. 52	0. 48	26. 1	0. 50	26. 35	0. 51	26. 52	0. 51
28	21. 38	0. 42	22. 47	0. 45	23. 57	0. 47	25. 6	0. 50	26. 16	0. 52	26. 51	0. 53	27. 8	0. 54
29	21. 51	0. 44	23. 1	0. 47	24. 12	0. 49	25. 22	0. 52	26. 22	0. 54	27. 8	0. 55	27. 25	0. 56
30	22. 5	0. 46	23. 16	0. 49	24. 27	0. 51	25. 38	0. 54	26. 49	0. 57	27. 25	0. 58	27. 43	0. 59
31	22. 20	0. 48	23. 31	0. 51	24. 43	0. 53	25. 56	0. 56	27. 7	0. 59	27. 44	1. 0	28. 2	1. 1
32	22. 35	0. 50	23. 47	0. 53	25. 0	0. 56	26. 13	0. 58	27. 26	1. 1	28. 3	1. 3	28. 21	1. 4
33	22. 51	0. 52	24. 4	0. 55	25. 18	0. 58	26. 32	1. 1	27. 46	1. 4	28. 24	1. 5	28. 42	1. 6
34	23. 7	0. 54	24. 22	0. 57	25. 37	1. 0	26. 52	1. 3	28. 7	1. 7	28. 45	1. 8	29. 4	1. 9
35	23. 25	0. 56	24. 41	0. 59	25. 57	1. 2	27. 13	1. 6	28. 30	1. 9	29. 8	1. 11	29. 27	1. 12
36	23. 44	0. 58	25. 1	1. 1	26. 18	1. 5	27. 35	1. 8	28. 53	1. 12	29. 32	1. 14	29. 51	1. 15
37	24. 3	1. 0	25. 21	1. 4	26. 40	1. 7	27. 58	1. 11	29. 17	1. 15	29. 57	1. 16	30. 17	1. 17
38	24. 24	1. 2	25. 43	1. 6	27. 3	1. 10	28. 23	1. 14	29. 44	1. 17	30. 24	1. 19	30. 44	1. 20
39	24. 46	1. 5	26. 7	1. 9	27. 28	1. 12	28. 49	1. 16	30. 11	1. 20	30. 52	1. 22	31. 13	1. 24
40	25. 9	1. 7	26. 31	1. 11	27. 54	1. 15	29. 17	1. 19	30. 40	1. 23	31. 22	1. 25	31. 43	1. 27
41	25. 33	1. 10	26. 57	1. 14	28. 21	1. 18	29. 46	1. 22	31. 11	1. 27	31. 54	1. 29	32. 15	1. 30
42	25. 59	1. 12	27. 24	1. 17	28. 50	1. 21	30. 16	1. 25	31. 43	1. 30	32. 27	1. 32	32. 49	1. 34
43	26. 26	1. 15	27. 53	1. 19	29. 20	1. 24	30. 49	1. 29	32. 18	1. 33	33. 3	1. 35	33. 25	1. 37
44	26. 55	1. 18	28. 24	1. 22	29. 53	1. 27	31. 23	1. 32	32. 54	1. 37	33. 46	1. 39	34. 3	1. 41
45	27. 25	1. 21	28. 56	1. 25	30. 27	1. 30	31. 59	1. 35	33. 33	1. 40	34. 20	1. 43	34. 43	1. 44
46	27. 57	1. 24	29. 30	1. 29	31. 3	1. 34	32. 38	1. 39	34. 14	1. 44	35. 2	1. 47	35. 26	1. 48
47	28. 31	1. 27	30. 6	1. 32	31. 42	1. 37	33. 19	1. 43	34. 57	1. 48	35. 47	1. 51	36. 12	1. 52
48	29. 7	1. 30	30. 44	1. 35	32. 23	1. 41	34. 3	1. 47	35. 44	1. 53	36. 35	1. 56	37. 0	1. 57
49	29. 45	1. 33	31. 25	1. 39	33. 6	1. 45	34. 49	1. 51	36. 33	1. 57	37. 26	2. 0	37. 52	2. 1
50	30. 26	1. 37	32. 9	1. 43	33. 53	1. 49	35. 38	1. 55	37. 26	2. 2	38. 20	2. 5	38. 48	2. 6
51	31. 9	1. 41	32. 55	1. 47	34. 43	1. 53	36. 32	2. 0	38. 23	2. 6	39. 19	2. 9	39. 47	2. 11
52	31. 56	1. 45	33. 45	1. 51	35. 36	1. 58	37. 29	2. 5	39. 24	2. 12	40. 22	2. 15	40. 51	2. 17
53	32. 45	1. 49	34. 33	1. 56	36. 33	2. 2	38. 30	2. 10	40. 29	2. 17	41. 29	2. 21	42. 0	2. 23
54	33. 38	1. 53	35. 35	2. 0	37. 34	2. 8	39. 36	2. 15	41. 40	2. 23	42. 43	2. 27	43. 15	2. 29
55	34. 35	1. 58	36. 36	2. 5	38. 40	2. 13	40. 47	2. 21	42. 56	2. 29	44. 3	2. 33	44. 36	2. 35
56	35. 36	2. 3	37. 42	2. 11	39. 51	2. 19	42. 4	2. 27	44. 20	2. 36	45. 29	2. 40	46. 4	2. 43
57	36. 42	2. 8	38. 54	2. 16	41. 9	2. 25	43. 27	2. 34	45. 51	2. 43	47. 4	2. 48	47. 41	2. 50
58	37. 54	2. 14	40. 12	2. 22	42. 33	2. 32	44. 59	2. 41	47. 30	2. 51	48. 48	2. 56	49. 28	2. 59
59	39. 12	2. 20	41. 37	2. 29	44. 6	2. 39	46. 40	2. 49	49. 21	3. 0	50. 44	3. 5	51. 26	3. 8
60	40. 37	2. 26	43. 10	2. 36	45. 47	2. 47	48. 32	2. 58	51. 24	3. 9	52. 54	3. 15	53. 40	3. 19
61	42. 11	2. 34	44. 52	2. 44	47. 40	2. 55	50. 36	3. 7	53. 42	3. 20	55. 20	3. 27	56. 10	3. 30
62	43. 55	2. 41	46. 46	2. 53	49. 46	3. 5	52. 56	3. 18	56. 20	3. 32	58. 9	3. 39	59. 5	3. 43
63	45. 49	2. 50	48. 53	3. 2	52. 8	3. 16	55. 36	3. 30	59. 23	3. 46	61. 26	3. 55	62. 31	3. 59
64	47. 58	3. 0	51. 17	3. 13	54. 50	3. 28	58. 43	3. 44	63. 2	4. 2	65. 27	4. 13	66. 45	4. 18

(z 1) The Time from Noon, at which the True Bearing of the Sun is E. or W.

Declination of the same Name as the Latitude.

Lat.	0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°
°	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0
1	6. 0	4. 0	5. 2	5. 22	5. 31	5. 37	5. 41	5. 44	5. 46	5. 48	5. 49	5. 50	5. 51
2	6. 0	0. 0	4. 0	4. 42	5. 2	5. 14	5. 22	5. 28	5. 32	5. 35	5. 38	5. 40	5. 42
3	6. 0	3. 13	2. 46	4. 0	4. 32	4. 51	5. 3	5. 11	5. 18	5. 23	5. 27	5. 30	5. 33
4	6. 0	4. 0	0. 0	3. 13	4. 1	4. 27	4. 43	4. 55	5. 4	5. 10	5. 16	5. 20	5. 24
5	6. 0	4. 26	2. 28	2. 15	3. 26	4. 1	4. 23	4. 38	4. 49	4. 58	5. 4	5. 10	5. 15
6	6. 0	4. 42	3. 13	0. 0	2. 46	3. 34	4. 1	4. 20	4. 34	4. 45	4. 53	5. 0	5. 5
7	6. 0	4. 54	3. 41	2. 5	1. 56	3. 3	3. 39	4. 2	4. 19	4. 31	4. 41	4. 49	4. 56
8	6. 0	5. 2	4. 1	2. 46	0. 0	2. 29	3. 14	3. 43	4. 3	4. 17	4. 29	4. 39	4. 46
9	6. 0	5. 9	4. 15	3. 14	1. 50	1. 44	2. 47	3. 22	3. 46	4. 3	4. 17	4. 28	4. 37
10	6. 0	5. 14	4. 27	3. 34	2. 29	0. 0	2. 16	3. 0	3. 28	3. 49	4. 4	4. 16	4. 27
11	6. 0	5. 19	4. 36	3. 49	2. 55	1. 40	1. 35	2. 35	3. 9	3. 33	3. 51	4. 5	4. 16
12	6. 0	5. 22	4. 43	4. 1	3. 14	2. 16	0. 0	2. 6	2. 49	3. 17	3. 37	3. 53	4. 6
13	6. 0	5. 25	4. 49	4. 12	3. 30	2. 41	1. 32	1. 29	2. 26	2. 59	3. 23	3. 41	3. 55
14	6. 0	5. 28	4. 55	4. 20	3. 43	3. 0	2. 6	0. 0	1. 58	2. 40	3. 7	3. 28	3. 44
15	6. 0	5. 30	4. 59	4. 28	3. 53	3. 15	2. 30	1. 26	1. 23	2. 18	2. 50	3. 14	3. 32
16	6. 0	5. 32	5. 4	4. 34	4. 3	3. 28	2. 49	1. 58	0. 0	1. 52	2. 32	2. 59	3. 20
17	6. 0	5. 34	5. 7	4. 40	4. 11	3. 39	3. 4	2. 21	1. 21	1. 19	2. 11	2. 43	3. 7
18	6. 0	5. 35	5. 10	4. 45	4. 17	3. 49	3. 17	2. 40	1. 52	0. 0	1. 47	2. 26	2. 53
19	6. 0	5. 37	5. 13	4. 49	4. 24	3. 57	3. 28	2. 54	2. 14	1. 17	1. 16	2. 6	2. 37
20	6. 0	5. 38	5. 16	4. 53	4. 29	4. 4	3. 37	3. 7	2. 32	1. 47	0. 0	1. 43	2. 21
21	6. 0	5. 39	5. 18	4. 56	4. 34	4. 11	3. 46	3. 18	2. 47	2. 9	1. 14	1. 13	2. 2
22	6. 0	5. 40	5. 20	5. 0	4. 39	4. 16	3. 53	3. 28	2. 59	2. 26	1. 43	0. 0	1. 39
23	6. 0	5. 41	5. 22	5. 3	4. 43	4. 22	4. 0	3. 36	3. 10	2. 40	2. 4	1. 11	1. 10
24	6. 0	5. 42	5. 24	5. 5	4. 46	4. 27	4. 6	3. 44	3. 20	2. 53	2. 21	1. 39	0. 0
25	6. 0	5. 43	5. 26	5. 8	4. 50	4. 31	4. 12	3. 51	3. 28	3. 3	2. 35	2. 0	1. 9
26	6. 0	5. 44	5. 27	5. 10	4. 53	4. 35	4. 17	3. 57	3. 36	3. 13	2. 47	2. 16	1. 36
27	6. 0	5. 44	5. 28	5. 12	4. 56	4. 39	4. 21	4. 3	3. 43	3. 22	3. 0	2. 30	1. 56
28	6. 0	5. 45	5. 30	5. 14	4. 59	4. 43	4. 26	4. 8	3. 49	3. 29	3. 7	2. 42	2. 13
29	6. 0	5. 46	5. 31	5. 16	5. 1	4. 46	4. 30	4. 13	3. 55	3. 36	3. 16	2. 53	2. 26
30	6. 0	5. 46	5. 32	5. 18	5. 4	4. 49	4. 34	4. 18	4. 1	3. 43	3. 24	3. 2	2. 38
31	6. 0	5. 47	5. 33	5. 20	5. 6	4. 52	4. 37	4. 22	4. 6	3. 49	3. 31	3. 11	2. 49
32	6. 0	5. 47	5. 34	5. 21	5. 8	4. 54	4. 40	4. 26	4. 11	3. 55	3. 38	3. 19	2. 58
33	6. 0	5. 48	5. 35	5. 23	5. 10	4. 57	4. 44	4. 30	4. 15	4. 0	3. 44	3. 26	3. 7
34	6. 0	5. 48	5. 36	5. 24	5. 12	4. 59	4. 47	4. 33	4. 19	4. 5	3. 49	3. 33	3. 15
35	6. 0	5. 49	5. 37	5. 25	5. 14	5. 2	4. 49	4. 37	4. 23	4. 9	3. 55	3. 39	3. 22
36	6. 0	5. 49	5. 38	5. 27	5. 15	5. 4	4. 52	4. 40	4. 27	4. 14	4. 0	3. 45	3. 29
37	6. 0	5. 49	5. 39	5. 28	5. 17	5. 6	4. 54	4. 43	4. 31	4. 18	4. 4	3. 50	3. 35
38	6. 0	5. 50	5. 39	5. 29	5. 19	5. 8	4. 57	4. 46	4. 34	4. 22	4. 9	3. 55	3. 41
39	6. 0	5. 50	5. 40	5. 30	5. 20	5. 10	4. 59	4. 48	4. 37	4. 25	4. 13	4. 0	3. 47
40	6. 0	5. 50	5. 41	5. 31	5. 21	5. 11	5. 1	4. 51	4. 40	4. 29	4. 17	4. 5	3. 52
41	6. 0	5. 51	5. 42	5. 32	5. 23	5. 13	5. 3	4. 53	4. 43	4. 32	4. 21	4. 9	3. 57
42	6. 0	5. 51	5. 42	5. 33	5. 24	5. 15	5. 5	4. 56	4. 46	4. 35	4. 25	4. 13	4. 1
43	6. 0	5. 51	5. 43	5. 34	5. 25	5. 16	5. 7	4. 58	4. 48	4. 38	4. 28	4. 17	4. 6
44	6. 0	5. 52	5. 43	5. 35	5. 27	5. 18	5. 9	5. 0	4. 51	4. 41	4. 31	4. 21	4. 10
45	6. 0	5. 52	5. 44	5. 36	5. 28	5. 19	5. 11	5. 2	4. 53	4. 44	4. 35	4. 25	4. 14
46	6. 0	5. 52	5. 45	5. 37	5. 29	5. 22	5. 13	5. 4	4. 56	4. 47	4. 38	4. 28	4. 18
47	6. 0	5. 53	5. 45	5. 38	5. 30	5. 22	5. 14	5. 6	4. 58	4. 49	4. 41	4. 31	4. 22
48	6. 0	5. 53	5. 46	5. 38	5. 31	5. 23	5. 16	5. 8	5. 0	4. 52	4. 43	4. 35	4. 25
49	6. 0	5. 53	5. 46	5. 39	5. 32	5. 25	5. 17	5. 10	5. 2	4. 54	4. 46	4. 38	4. 29
50	6. 0	5. 53	5. 47	5. 40	5. 33	5. 26	5. 19	5. 12	5. 4	4. 57	4. 49	4. 41	4. 32
52	6. 0	5. 54	5. 47	5. 41	5. 35	5. 28	5. 22	5. 15	5. 8	5. 1	4. 54	4. 46	4. 39
54	6. 0	5. 54	5. 48	5. 42	5. 37	5. 31	5. 24	5. 18	5. 12	5. 5	4. 59	4. 52	4. 45
56	6. 0	5. 55	5. 49	5. 44	5. 38	5. 33	5. 27	5. 21	5. 15	5. 9	5. 3	4. 57	4. 50
58	6. 0	5. 55	5. 50	5. 45	5. 40	5. 35	5. 29	5. 24	5. 19	5. 13	5. 7	5. 2	4. 55
60	6. 0	5. 55	5. 51	5. 46	5. 41	5. 37	5. 32	5. 27	5. 22	5. 17	5. 11	5. 6	5. 0
62	6. 0	5. 56	5. 51	5. 47	5. 43	5. 38	5. 34	5. 30	5. 25	5. 20	5. 15	5. 10	5. 5
64	6. 0	5. 56	5. 52	5. 48	5. 44	5. 40	5. 36	5. 32	5. 28	5. 24	5. 19	5. 15	5. 10
66	6. 0	5. 56	5. 53	5. 49	5. 46	5. 42	5. 38	5. 35	5. 31	5. 27	5. 23	5. 19	5. 14
68	6. 0	5. 57	5. 54	5. 50	5. 47	5. 44	5. 40	5. 37	5. 33	5. 30	5. 26	5. 22	5. 19
70	6. 0	5. 57	5. 54	5. 51	5. 48	5. 45	5. 42	5. 39	5. 36	5. 33	5. 30	5. 26	5. 23

Equations of Second Differences for 12 Hours.

(z 2)

Time after Noon or Midnight.			Second Difference.											
			1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'
h. m.	h. m.	h. m.												
12. 0	0. 0	0. 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.50	0.10	0.4	0.3	0.8	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1	4.5	4.9
11.40	0.20	0.8	1.6	2.4	3.2	4.1	4.9	5.7	6.5	7.3	8.1	8.9	9.7	
11.30	0.30	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	13.2	14.4	
11.20	0.40	1.6	3.1	4.7	6.3	7.9	9.4	11.0	12.6	14.2	15.7	17.3	18.9	
11.10	0.50	1.9	3.9	5.8	7.8	9.7	11.6	13.6	15.5	17.4	19.4	21.3	23.3	
11. 0	1. 0	2.3	4.6	6.9	9.2	11.5	13.8	16.0	18.3	20.6	22.9	25.2	27.5	
10.50	1.10	2.6	5.3	7.9	10.5	13.2	15.8	18.4	21.1	23.7	26.3	29.0	31.6	
10.40	1.20	3.0	5.9	8.9	11.9	14.8	17.8	20.7	23.7	26.7	29.6	32.6	35.6	
10.30	1.30	3.3	6.6	9.8	13.1	16.4	19.7	23.0	26.3	29.5	32.8	36.1	39.4	
10.20	1.40	3.6	7.2	10.8	14.4	17.9	21.5	25.1	28.7	32.3	35.9	39.5	43.1	
10.10	1.50	3.9	7.8	11.6	15.5	19.4	23.3	27.2	31.1	34.9	38.8	42.7	46.6	
10. 0	2. 0	4.2	8.3	12.5	16.7	20.8	25.0	29.2	33.3	37.5	41.7	45.8	50.0	
9.50	2.10	4.4	8.9	13.3	17.8	22.2	26.6	31.1	35.5	39.9	44.4	48.8	53.3	
9.40	2.20	4.7	9.4	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0	51.7	56.4	
9.30	2.30	4.9	9.9	14.8	19.8	24.7	29.7	34.6	39.6	44.5	49.5	54.4	59.4	
9.20	2.40	5.2	10.4	15.6	20.7	25.9	31.1	36.3	41.5	46.7	51.9	57.0	62.2	
9.10	2.50	5.4	10.8	16.2	21.6	27.1	32.5	37.9	43.3	48.7	54.1	59.5	64.9	
9. 0	3. 0	5.6	11.3	16.9	22.5	28.1	33.8	39.4	45.0	50.6	56.3	61.9	67.5	
8.50	3.10	5.8	11.7	17.5	23.3	29.1	35.0	40.8	46.6	52.4	58.3	64.1	69.9	
8.40	3.20	6.0	12.0	18.1	24.1	30.1	36.1	42.1	48.1	54.2	60.2	66.2	72.2	
8.30	3.30	6.2	12.4	18.6	24.8	31.0	37.2	43.4	49.6	55.8	62.0	68.2	74.4	
8.20	3.40	6.4	12.7	19.1	25.5	31.8	38.2	44.6	50.9	57.3	63.7	70.0	76.4	
8.10	3.50	6.5	13.0	19.6	26.1	32.6	39.1	45.7	52.2	58.7	65.2	71.7	78.3	
8. 0	4. 0	6.7	13.4	20.0	26.7	33.3	40.1	46.7	53.3	60.0	66.7	73.3	80.0	
7.40	4.20	6.9	13.8	20.8	27.7	34.6	41.5	48.4	55.4	62.3	69.2	76.1	83.1	
7.20	4.40	7.1	14.3	21.4	28.5	35.6	42.8	49.9	57.0	64.2	71.3	78.4	85.6	
7. 0	5. 0	7.3	14.6	21.9	29.2	36.5	43.8	51.0	58.3	65.6	72.9	80.2	87.5	
6.40	5.20	7.4	14.8	22.2	29.6	37.0	44.4	51.9	59.3	66.7	74.1	81.5	88.9	
6.20	5.40	7.5	15.0	22.4	29.9	37.4	44.9	52.3	59.8	67.3	74.8	82.2	89.7	
6. 0	6. 0	7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	67.5	75.0	82.5	90.0	

Time after Noon or Midnight.			Second Difference.													
			10''	20''	30''	40''	50''	1''	2''	3''	4''	5''	6''	7''	8''	9''
h. m.	h. m.															
12. 0	0. 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.50	0.10	0.1	0.1	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
11.40	0.20	0.1	0.3	0.4	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
11.30	0.30	0.2	0.4	0.6	0.8	1.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
11.20	0.40	0.3	0.5	0.8	1.0	1.3	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
11.10	0.50	0.3	0.6	1.0	1.3	1.6	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3
11. 0	1. 0	0.4	0.8	1.1	1.5	1.9	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3
10.50	1.10	0.4	0.9	1.3	1.8	2.2	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.4
10.40	1.20	0.5	1.0	1.5	2.0	2.5	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4
10.30	1.30	0.5	1.1	1.6	2.2	2.7	0.0	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5
10.20	1.40	0.6	1.2	1.8	2.4	3.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6
10.10	1.50	0.6	1.3	1.9	2.6	3.2	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6
10. 0	2. 0	0.7	1.4	2.1	2.8	3.5	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7
9.50	2.10	0.7	1.5	2.2	3.0	3.7	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.7
9.40	2.20	0.8	1.6	2.3	3.1	3.9	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8
9.30	2.30	0.8	1.6	2.5	3.3	4.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8
9.20	2.40	0.9	1.7	2.6	3.5	4.3	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.8
9.10	2.50	0.9	1.8	2.7	3.6	4.5	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9
9. 0	3. 0	0.9	1.9	2.8	3.8	4.7	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9
8.50	3.10	1.0	1.9	2.9	3.9	4.9	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
8.40	3.20	1.0	2.0	3.0	4.0	5.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
8.30	3.30	1.0	2.1	3.1	4.1	5.2	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
8.20	3.40	1.1	2.1	3.2	4.2	5.3	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
8.10	3.50	1.1	2.2	3.3	4.3	5.4	0.1	0.2	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.1
8. 0	4. 0	1.1	2.2	3.3	4.4	5.6	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.0	1.1
7.40	4.20	1.2	2.3	3.5	4.6	5.8	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.1
7.20	4.40	1.2	2.4	3.6	4.8	5.9	0.1	0.2	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
7. 0	5. 0	1.2	2.4	3.6	4.9	6.1	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.0	1.1
6.40	5.20	1.2	2.4	3.7	4.9	6.2	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.1
6.20	5.40	1.3	2.5	3.8	5.0	6.2	0.1	0.2	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.1
6. 0	6. 0	1.3	2.5	3.8	5.0	6.3	0.1	0.2	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.1

(z 3) Mean Motion of the Sun's Right Ascension for Sidereal Hours.

Hours.	Motion.	Minutes.	Motion.	Minutes.	Motion.	Seconds.	Motion.
1	0 9.83	1	0.16	31	5.08	3	0.01
2	0 19.66	2	0.33	32	5.24	6	0.02
3	0 29.49	3	0.49	33	5.41	9	0.02
4	0 39.32	4	0.65	34	5.57	12	0.03
5	0 49.15	5	0.82	35	5.73	15	0.04
6	0 58.98	6	0.98	36	5.90	18	0.05
7	1 8.81	7	1.15	37	6.06	21	0.06
8	1 18.64	8	1.31	38	6.22	24	0.06
9	1 28.46	9	1.47	39	6.39	27	0.07
10	1 38.29	10	1.64	40	6.55	30	0.08
11	1 48.12	11	1.80	41	6.72	33	0.09
12	1 57.95	12	1.97	42	6.88	36	0.10
13	2 7.78	13	2.13	43	7.04	39	0.11
14	2 17.61	14	2.29	44	7.21	42	0.11
15	2 27.44	15	2.46	45	7.37	45	0.12
16	2 37.27	16	2.62	46	7.54	48	0.13
17	2 47.10	17	2.78	47	7.70	51	0.14
18	2 56.93	18	2.95	48	7.86	54	0.15
19	3 6.76	19	3.11	49	8.03	57	0.16
20	3 16.59	20	3.28	50	8.19	60	0.16
21	3 26.42	21	3.44	51	8.35		
22	3 36.25	22	3.60	52	8.51		
23	3 46.08	23	3.77	53	8.68		
24	3 55.91	24	3.93	54	8.85		
25	4 5.74	25	4.10	55	9.01		
26	4 15.57	26	4.26	56	9.17		
27	4 25.40	27	4.42	57	9.34		
28	4 35.22	28	4.59	58	9.50		
29	4 45.05	29	4.75	59	9.67		
30	4 54.88	30	4.91	60	9.83		

(z 4) Correction of Mean Refraction.

AA	Bar. +1 in.	Ther. +10°	AA	Bar. +1 in.	Ther. +10°	AA	Bar. +1 in.	Ther. +10°	AA	Bar. +1 in.	Ther. +10°	AA	Bar. +1 in.	Ther. +10°
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
5	20.10	13.80	23	4.57	2.76	41	2.24	1.34	59	1.17	0.70	77	0.45	0.27
6	17.20	11.50	24	4.35	2.64	42	2.16	1.30	60	1.12	0.67	78	0.41	0.25
7	15.00	9.80	25	4.16	2.52	43	2.09	1.25	61	1.08	0.65	79	0.38	0.23
8	13.30	8.50	26	3.97	2.41	44	2.02	1.20	62	1.04	0.62	80	0.34	0.21
9	11.90	7.60	27	3.81	2.30	45	1.94	1.17	63	0.99	0.60	81	0.31	0.18
10	10.80	6.90	28	3.65	2.19	46	1.88	1.12	64	0.95	0.57	82	0.27	0.16
11	9.80	6.00	29	3.50	2.09	47	1.81	1.08	65	0.91	0.55	83	0.24	0.14
12	9.00	5.56	30	3.36	2.01	48	1.75	1.04	66	0.87	0.52	84	0.20	0.12
13	8.30	5.09	31	3.23	1.93	49	1.69	1.01	67	0.83	0.50	85	0.17	0.10
14	7.70	4.69	32	3.11	1.86	50	1.63	0.97	68	0.79	0.47	86	0.14	0.08
15	7.18	4.39	33	2.99	1.79	51	1.58	0.94	69	0.75	0.45	87	0.10	0.06
16	6.73	4.11	34	2.88	1.73	52	1.52	0.90	70	0.71	0.43	88	0.07	0.04
17	6.31	3.86	35	2.78	1.67	53	1.47	0.88	71	0.67	0.40	89	0.03	0.02
18	5.98	3.62	36	2.68	1.61	54	1.41	0.85	72	0.63	0.38			
19	5.61	3.40	37	2.58	1.55	55	1.36	0.82	73	0.59	0.36			
20	5.31	3.22	38	2.49	1.49	56	1.31	0.79	74	0.56	0.33			
21	5.04	3.05	39	2.40	1.44	57	1.26	0.76	75	0.52	0.31			
22	4.79	2.90	40	2.32	1.39	58	1.22	0.73	76	0.48	0.29			
	—	+		—	+		—	+		—	+		—	+
AA	Bar. -1 in.	Ther. -10°	AA	Bar. -1 in.	Ther. -10°	AA	Bar. -1 in.	Ther. -10°	AA	Bar. -1 in.	Ther. -10°	AA	Bar. -1 in.	Ther. -10°

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Aalborg, Denmark.....	57° 3' N	9° 57' E	Aleppo, Turkey in Asia.....	36° 11' N	37° 10' E
Aarhus, Denmark.....	56° 10' N	10° 14' E	Alet, France.....	43° 0' N	2° 15' E
Aars, Jutland.....	56° 9' N	10° 19' E	Alexander, Port, West Coast of Africa	15° 52' S	12° 0' E
Abaco Isle, N.E. Point, Lucayos.....	26° 30' N	77° 3' W	Alexandretta, Turkey in Asia.....	36° 35' N	36° 15' E
—— Rocky Point, Lucayos.....	26° 17' N	77° 6' W	Alexandria, Egypt.....	31° 13' N	29° 55' E
—— S Point, Lucayos.....	25° 50' N	77° 20' W	Algésiras, Spain.....	36° 8' N	5° 26' W
Abbeville, France.....	50° 7' N	1° 50' E	Algiers Lighthouse, Barbary.....	36° 49' N	3° 5' E
Abbs, St., Head, Scotland.....	55° 55' N	2° 8' W	Algoa Bay, Cape Recife, S. C. of Africa	34° 1' S	25° 40' E
Aberdeen Obs., Scotland.....	57° 9' N	2° 9' W	Alicante, Spain.....	38° 21' N	0° 29' W
Abergele Steeple, Wales.....	53° 17' N	3° 34' W	Alicata Castle, Sicily.....	37° 4' N	13° 57' E
Aberystwith, Wales.....	52° 23' N	3° 53' W	Alicuri Isle, the Church, Mediter.....	38° 34' N	14° 14' E
Abbotsbury Signal Staff, England.....	50° 41' N	2° 37' W	Alkanais, Barbary.....	31° 15' N	27° 56' E
Abington I. C. Ibbotson, Galapagos Isles	0° 29' N	90° 44' W	Alkmaer, Netherlands.....	52° 38' N	4° 45' E
Abo, Finland.....	60° 27' N	22° 20' E	Almaguer, Terra Firma.....	1° 54' N	76° 55' W
Aboukir Tower, Egypt.....	31° 20' N	30° 17' E	Almeria, Spain.....	36° 51' N	2° 31' W
Abrolhos Shoals, New Holland.....	28° 30' S	110° 45' E	Alost, Netherlands.....	50° 56' N	4° 2' E
Abrolhos Isles, Brazil.....	17° 58' S	38° 26' W	Alphonse Isle, Indian Ocean.....	7° 4' S	52° 49' E
Acapulco, Mexico.....	16° 50' N	99° 49' W	Altdorf, Germany.....	47° 45' N	9° 34' E
Acheen Head, Sumatra.....	5° 36' N	95° 19' E	Altengaard, Lapland.....	69° 55' N	23° 4' E
Achill Head, Ireland.....	54° 7' N	10° 30' W	Alténrode, Germany.....	51° 51' N	10° 44' E
Acre, Syria.....	32° 55' N	35° 6' E	Alto-velo Rock, St. Domingo.....	17° 30' N	71° 20' W
Adalia Pier Head, Turkey in Asia.....	36° 52' N	30° 45' E	—— St. Domingo.....	17° 28' N	71° 39' W
Adelsberg, Germany.....	45° 38' N	14° 23' E	Amag Isle Drago, Cattegat.....	55° 35' N	12° 41' E
Aden Cape, Arabia.....	12° 44' N	45° 14' E	Amargura Isle, Friendly Isles.....	18° 0' S	174° 35' W
Admiralty Isle, Pacific Ocean.....	2° 12' S	146° 12' E	Amassero, Turkey in Asia.....	41° 46' N	32° 24' E
Adramittia, Turkey.....	39° 37' N	27° 5' E	Amazon R. Ent., Guayana.....	1° 25' S	50° 5' W
Adria, Italy.....	45° 3' N	12° 4' E	Amber Cape, Madagascar.....	12° 2' S	49° 20' E
Adrianople, Turkey.....	41° 3' N	27° 8' E	Amblaw Isle, Indian Archipelago.....	3° 52' S	127° 10' E
Adventure Isle, Pacific Ocean.....	17° 10' S	144° 30' W	Amboyna Bay, Fort Victoria, Ind. Arch.....	3° 40' S	128° 15' E
Africa, Barbary.....	35° 30' N	11° 6' E	Ambrose (St.) Isle, Pacific Ocean.....	26° 20' S	79° 51' W
African Isle, S. Isle, Indian Ocean.....	4° 55' S	54° 9' E	Amiens, France.....	49° 54' N	2° 18' E
Afuera Isle, Pacific Ocean.....	33° 45' S	80° 22' W	Ambrym Isle, Pacific Ocean.....	16° 9' S	167° 52' E
Agile, France.....	43° 19' N	3° 28' E	Amelia Isle, N. End, United States.....	30° 40' N	81° 35' W
Agén, France.....	44° 12' N	0° 37' E	Amirante Isles, S. Pt., Ind. Ocean.....	6° 20' S	54° 40' E
Ageroe Isle, Centre, Norway.....	59° 3' N	10° 57' E	Amoy Harb., Chapel Isle, Chinese Sea	24° 10' N	118° 10' E
Agimere, India.....	26° 35' N	75° 20' E	Amphitrite Isles, N. Isle, Paracels.....	16° 58' N	112° 15' E
Agio Strati Isle, Archipelago.....	39° 30' N	24° 50' E	Amsterdam, Netherlands.....	52° 22' N	4° 53' E
Agnes (St.) Beacon, England.....	50° 18' N	5° 12' W	Amsterdam Isle, Indian Archipelago.....	0° 19' S	132° 15' E
Agnes (St.) Isle, Lighthouse, Scilly Isles	49° 54' N	6° 19' W	Amsterdam Isle, W. Point, Ind. Ocean	37° 48' S	77° 25' E
Agra, India.....	27° 13' N	78° 17' E	Anambas, North, Chinese Sea.....	3° 27' N	106° 15' E
Agria, Hungary.....	47° 54' N	20° 22' E	Anamour, Cape, Turkey in Asia.....	36° 1' N	32° 51' E
Aguja Point, Peru.....	5° 59' S	81° 4' W	Ancona, Italy.....	43° 38' N	13° 29' E
Ahus, Sweden.....	55° 56' N	14° 16' E	Andaman Isle, (Gt.) N.E. Pt., Bay of Ben.	13° 34' N	93° 9' E
Aigues-Mortes, France.....	43° 34' N	4° 11' E	—— SE. Point, Bay of Bengal	11° 30' N	92° 56' E
Air Light, Scotland.....	55° 25' N	4° 26' W	—— (Little) SE. Point Bay of Beng.	10° 26' N	92° 40' E
Air Point Lighthouse, Wales.....	53° 21' N	3° 19' W	Andero (St.), Spain.....	43° 28' N	3° 40' W
Aire, France.....	43° 42' N	0° 16' W	Andrew's (St.), Scotland.....	56° 21' N	2° 45' W
Aix, France.....	43° 32' N	5° 27' E	Andrade Rock, China Sea.....	9° 56' N	109° 54' E
Aix Isle, France.....	46° 2' N	1° 11' W	Anderson's Isle, Sea of Kamtschatka	63° 48' N	167° 38' W
Ajaccio, Corsica.....	41° 55' N	8° 44' E	Andrew's (St.) Cape, Cyprus.....	35° 42' N	34° 37' E
Akerman, Russia in Europe.....	46° 12' N	30° 44' E	Andrew's (St.) Isles, Pacific Ocean.....	5° 20' N	132° 16' E
Alacranes Isle, W. Isle, Gulf of Mexico	22° 30' N	89° 42' W	Andrew's (St.) Cape, Madagascar.....	16° 25' S	45° 16' E
Alais, France.....	44° 7' N	4° 4' E	Andrew's (St.) Isle, Caribbean Sea.....	12° 31' N	80° 59' W
Alausi, Peru.....	2° 13' S	79° 0' W	Anegada Isle, NW, Point, Carib. Isles	18° 46' N	64° 26' W
Albano, Italy.....	41° 44' N	12° 38' E	—— SE. Point, Caribbee Isles	18° 44' N	64° 17' W
Alban's (St.) Head, Cruch Barrow, Eng.	50° 38' N	2° 6' W	Angeles (los), Mexico.....	19° 0' N	98° 2' W
Albans, St., Jersey.....	49° 13' N	2° 11' W	Angers, France.....	47° 28' N	0° 33' W
Albany, United States.....	42° 39' N	73° 45' W	Angoulême, France.....	45° 39' N	0° 9' E
Albany Otway Cape, New South Wales	38° 51' S	143° 29' E	Angra Pq. Har. Ped., Pt., W. C. of Afr.	26° 37' S	15° 16' E
Albany House, New Wales.....	52° 15' N	81° 56' W	Angrias Bank, Indian Ocean.....	16° 30' N	71° 55' E
Albemar Isle, NW. Point, Pacific O.....	0° 2' N	91° 30' W	Anguilla Isle, N.E. Point, Carib. Isles	18° 16' N	63° 2' W
Albi, France.....	43° 56' N	2° 9' E	—— SW. Point, Caribbee Isles	18° 11' N	63° 16' W
Alboran Isle, Mediterranean.....	35° 57' N	3° 1' W	Anguille Cape, Newfoundland.....	47° 55' N	59° 22' W
Alcala de Henarez, Spain.....	40° 29' N	3° 23' W	Angulhas Cape, Africa.....	34° 55' S	20° 18' E
Alcmaer, Netherlands.....	52° 38' N	4° 45' E	Anholt Lighthouse, Denmark.....	56° 44' N	11° 39' E
Aldabra Isles, Indian Ocean.....	9° 17' S	46° 14' E	Aniwa Cape, Sachalin.....	46° 28' N	143° 30' E
Aldborough, England.....	52° 7' N	1° 40' E	Anjenga, India.....	8° 39' N	77° 0' E
Alderney Isle, N. End, France.....	49° 46' N	2° 9' W	Annan Spire, Scotland.....	54° 59' N	3° 15' W
Aleootskia Isles, E., Pacific Ocean.....	53° 54' N	166° 22' W	Annapolis Royal.....	44° 45' N	65° 46' W

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Annozona Isle, High Peak, Atlantic O.	1° 28'S	5° 30'E	Augsburg, Germany	48° 22'N	10° 55'E
Ann's (St.) Lighthouse, Wales	51° 41'N	5° 9'W	Augusta Lighthouse, Sicily	37° 13'N	15° 12'E
Ann's (St.) Shls., N. End, Africa	8° 10'N	13° 50'W	Augusta Shoal, Indian Ocean	33° 44'S	36° 16'E
Anthony's (St.) Head Flagstaff, Eng.	50° 9'N	4° 59'W	Augustine (St.), Florida	29° 48'N	81° 18'W
Anthony's (St.) I., NW. Pt., C. Verd I.	17° 11'N	25° 6'W	Augustine (St.) Bay, Labrador	51° 13'N	58° 47'W
Antibes, France	43° 35'N	7° 8'E	Augustine (St.) B., Sandy I. Madagas.	23° 39'S	44° 0'E
Anticosti Isle, Jup. Inlet, Gf. of St. Law.	49° 26'N	63° 38'W	Augustine (St.) Cape, Brazil	8° 23'S	34° 56'W
Antigua Isle, Ft. Hamilton, Carib. Isles	17° 42'N	61° 55'W	Aurich, Germany	53° 28'N	7° 27'E
Antioch Island, Mediterranean	38° 55'N	8° 15'E	Aurora Isle, New Hebrides	15° 8'S	167° 58'E
Antongil Bay, Madagascar	15° 27'S	50° 23'E	— New Hebrides	15° 8'S	168° 17'E
Antonio (St.) Cape, Cuba	21° 54'N	84° 56'W	Autun, France	46° 57'N	4° 18'E
Antonio (St.) Cape, Spain	38° 58'N	0° 9'E	Auxerre, France	47° 48'N	3° 34'E
Antonio (St.) Cape, N. Pt., Paraguay	36° 20'S	56° 45'W	Aveiro, Portugal	40° 38'N	8° 38'W
— S. Pt., Paraguay	36° 55'S	56° 49'W	Aves Isle, Caribbee Isles	15° 30'N	63° 38'W
Antonio (St.) Port, Patagonia	45° 25'S	65° 49'W	Avignon, France	43° 57'N	4° 48'E
Antwerp, Netherlands	51° 13'N	4° 24'E	Avranches, France	48° 41'N	1° 21'W
Aor Isle, Indian Archipelago	2° 29'N	104° 34'E	Avulli, Switzerland	46° 10'N	6° 0'E
Apalache Bay, Florida	30° 0'N	84° 45'W	Awatscha Bay, Kamtschatka	52° 52'N	158° 47'E
Apee Isle, New Hebrides	16° 47'S	168° 7'E	Avavaca, Peru	4° 38'S	79° 41'W
Apenrade, Denmark	55° 27'N	9° 27'E	Aylesbury Steeple, England	51° 49'N	0° 49'W
Appolonia Cape, West Coast of Africa	5° 52'N	2° 39'W			
Apt, France	43° 52'N	5° 24'E	Baba Cape, Turkey in Asia	39° 30'N	25° 52'E
Apure River, the Mouth, Terra Firma	7° 36'N	66° 47'W	Babber Isle, Indian Archipelago	7° 25'S	130° 40'E
Aquileia, Italy	45° 46'N	13° 23'E	Bab-el-mandeb, Cape, Arabia	12° 40'N	43° 31'E
Aquin Bay, St. Domingo	18° 14'N	73° 21'W	Bagdad, Turkey in Asia	33° 20'N	44° 25'E
Aranda de Duero, Spain	41° 40'N	3° 41'W	Bahama Isle (Grand), W. Pt., Lucayos	26° 43'N	78° 56'W
Aranjuez, Spain	40° 28'N	3° 36'W	Bajador Cape, Morocco	26° 12'N	14° 27'W
Arcas (las) Isles, Nthm. I., Gf. of Mex.	20° 16'N	91° 54'W	Bajoly Cape, Minorca	40° 3'N	3° 52'E
Archangel, Rl. Arsenal, Russia	64° 34'N	40° 43'E	Baker's Isle Light, United States	42° 32'N	70° 50'W
Arcot, India	12° 54'N	79° 22'E	Balakab Peak, Indian Archipelago	7° 59'N	117° 3'E
Arendal, Norway	58° 27'N	8° 51'E	Balade H., Bouguioe I., N. Caledonia	20° 17'S	164° 26'E
Arensberg, Russia in Europe	58° 15'N	22° 28'E	— N. Caledonia	20° 18'S	164° 41'E
Arentes Isle, Indian Archipelago	5° 10'S	114° 36'E	Balagonan Point, Mindanao	7° 51'N	122° 24'E
Argental Cape, Italy	42° 23'N	11° 10'E	Balambangan Isle, Indian Archipelago	7° 16'N	116° 58'E
Arguin Bank, N. End, W. C. of Africa	20° 33'N	16° 56'W	Balasore, India	21° 30'N	87° 1'E
Arica, Peru	18° 27'S	70° 16'W	Bald Cape, Newfoundland	51° 40'N	55° 28'W
Arklow, Ireland	52° 49'N	6° 7'W	Bald Head, New Holland	35° 6'S	118° 1'E
Arles, France	43° 41'N	4° 38'E	Bally Isle, S. Point, Ind. Archipelago	8° 57'S	115° 9'E
Arnhem Cape, Mid. Point, N. Holland	12° 18'S	137° 0'E	Bal, R. Entrance, Greenland	64° 10'N	51° 47'W
Arona, Colossus of (St.) Charles, Italy	45° 46'N	8° 33'E	Baltimore, Ireland	51° 27'N	9° 26'W
Arras, France	50° 18'N	2° 46'E	Baltimore, United States	39° 22'N	76° 55'W
Aroa Isle, (Round), Str. of Malacca	2° 49'N	100° 49'E	Bamburgh Castle, England	55° 37'N	1° 42'W
Arran N. Isle, Ireland	53° 19'N	10° 2'W	Bamff, Scotland	57° 40'N	2° 32'W
Arranmore, Ireland	55° 22'N	8° 38'W	Bampton's Shoals, Centre, Pacific O.	19° 9'S	158° 23'E
Aroa Isle (Gt.), S. Point, Ind. Archip.	7° 6'S	135° 0'E	Banca Isle, Indian Archipelago	1° 52'N	125° 24'E
Arundel, England	50° 51'N	0° 36'W	Banca Isle, Monopin Hill, Ind. Archip.	2° 0'S	105° 14'E
Asaph (St.) Cathedral, Wales	53° 15'N	3° 26'W	Bancoot River, Entrance, India	17° 57'N	73° 9'E
Ascension Isle, Atlantic Ocean	7° 57'S	13° 59'W	Banda Isle, the Anchorage, Ind. Arch.	4° 31'S	130° 0'E
— Cross Hill, Atlantic O.	7° 56'S	14° 13'W	Bangalore, India	12° 58'N	77° 33'E
Ascension Isle, Carolinas	6° 53'N	158° 53'E	Banguey, Indian Archipelago	7° 17'N	117° 30'E
Asia's Isles, S. Westernm. I. Ind. Arch.	1° 0'N	131° 17'E	Banks' (Sir J.) Island, Pacific Ocean	13° 27'S	167° 24'E
Asinara Isle, Highest Point, Sardinia	41° 6'N	8° 18'E	Banks' Isle, New Zealand	43° 43'S	173° 4'E
Aspo, Russia	60° 14'N	27° 22'E	Bantam Point, Java	5° 52'S	106° 2'E
Aspoe, Isle, N. End, Norway	61° 13'N	4° 46'E	Bantry Bay, Ireland	51° 34'N	10° 10'W
Assenade, Netherlands	51° 14'N	3° 45'E	Bantum Ledges, United States	43° 43'N	69° 33'W
Assisi, Italy	43° 48'N	12° 35'E	Baradello, Italy	45° 47'N	9° 6'E
Assumption Isle, Indian Ocean	9° 50'S	47° 16'E	Baracoa, Cuba	20° 22'N	74° 25'W
Assumption Isle, Pacific Ocean	19° 45'N	145° 35'E	Bar de St. Jago, Louisiana	26° 58'N	97° 31'W
Astove Isles, Indian Ocean	10° 20'S	53° 32'E	Barbadoes I., Bridgetown, Carib. Isles	13° 58'N	59° 41'W
Astracan, Russia in Europe	46° 21'N	48° 3'E	Barbadoes Island, Pacific Ocean	8° 54'N	178° 21'W
Ath, Netherlands	50° 42'N	3° 47'E	Barbara (St.), New Albion	34° 24'N	119° 7'W
Athens, Turkey in Europe	37° 58'N	23° 46'E	Barbary Point, W. Coast of Africa	15° 53'N	16° 31'W
Atkin's Shoal, Atlantic Ocean	55° 18'N	11° 15'W	Barbas Cape, West Coast of Africa	22° 15'N	16° 41'W
Atoui Isle, Road of Ouimea, Sand. Isles	21° 57'N	159° 39'W	Barbe, St. Isle, Indian Archipelago	0° 9'N	107° 24'E
Atures, Terra Firma	5° 39'N	67° 59'W	Barbuda Isle, Caribbee Isles	17° 38'N	61° 50'W
Atwood's Key, W. Point, Lucayos	23° 9'N	73° 48'W	Barcelore, Malabar Coast, India	13° 45'N	74° 45'E
Auch, France	43° 38'N	0° 35'E	Barcelona (New), Terra Firma	10° 7'N	64° 44'W
Auckland's IIs., N. Pt. Enby. I. Pacific	50° 30'S	166° 25'E	Barcelona, Tower of Montjoy, Spain	41° 22'N	2° 10'E
Aucutta Isle, Laccadives	10° 51'N	72° 31'E			

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Bardsey Island, England	52° 44' N	0° 43' W	Billiton, S. W. Point, Chinese Sea ..	3° 15' S	107° 36' E
Bareedy Harbour, Arabia	24° 17' N	37° 45' E	—— (S. E. Point), Chinese Sea ..	3° 16' S	108° 15' E
Barfleur Lighthouse, France	49° 40' N	1° 15' W	—— (N. Point), Chinese Sea ..	2° 33' S	107° 53' E
Bari, Gulf of Venice	41° 7' N	17° 0' E	Bintang, China Sea	1° 0' N	104° 25' E
Barmouth, England	52° 43' N	3° 52' W	Bjorneburg, Russia in Europe	61° 29' N	21° 43' E
Barnaould, Russia in Asia	53° 20' N	83° 27' E	Bird Island, Pacific Ocean	17° 49' S	142° 43' W
Barrilla, Mexico	18° 7' N	94° 27' W	Bird Island, West Coast of Africa ..	24° 36' S	14° 50' E
Barren Island, Bay of Bengal	12° 17' N	93° 54' E	Bird's Isles, Sandwich Isles	23° 8' N	161° 45' W
Barren Islands, Mozambique	18° 26' S	44° 15' E	Bird's Isles, Gulf of St. Lawrence ..	47° 55' N	60° 46' W
Barrow Harbour, Newfoundland ..	48° 52' N	53° 0' W	Bird Isle (Great), S. Coast of Africa.	33° 48' S	26° 20' E
Bartholomew (St.) Isle, Caribbee Isles	17° 57' N	62° 50' W	Bizati Port, Turkey in Europe	37° 18' N	22° 54' E
Baseelan Isle, E. Point, Ind. Archipe.	6° 30' N	120° 30' E	Bizerta, Barbary	37° 17' N	9° 51' E
Bashee Isles, Grafton I., Chinese Sea.	21° 4' N	121° 0' E	Black Head, England	50° 1' N	5° 4' W
Basle, Switzerland	47° 34' N	7° 35' E	Black Rock, Ireland	54° 13' N	10° 36' W
Bassano, Italy	45° 46' N	11° 45' E	Blanca Isle, N. Point, Caribbee Sea ..	11° 55' N	64° 32' W
Bassas Rocks (Great). Ceylon	6° 11' N	81° 39' E	Blanco Cape, Patagonia	47° 15' S	65° 57' W
Bassas-de-India Isle, Mozamb. Channel	22° 28' S	40° 37' E	Blanco Cape, Peru	4° 19' S	81° 6' W
Basseenfort, Malabar Coast, India ..	19° 19' N	72° 55' E	Blanco Cape, W. Coast of Africa ..	20° 47' S	17° 2' W
Bastia, Corsica	42° 42' N	9° 27' E	Blankenburg, Germany	51° 48' N	10° 57' E
Batavia Observatory, Java	6° 9' S	106° 52' E	Blas (St.) Port, Mexico	21° 33' N	105° 16' W
Baton Rouge, Louisiana	30° 36' N	91° 13' W	Block Island, United States	41° 10' N	71° 45' W
Bayeux, France	49° 17' N	0° 42' W	Blois, France	47° 35' N	1° 20' E
Bayonne, France	43° 29' N	1° 28' W	Blomoe Isle, Norway	60° 32' N	4° 54' E
Bazas, France	44° 26' N	0° 13' W	Blue Point, Russia in Europe	65° 30' N	40° 0' E
Bazaruto Isles, Mozambique Channel	21° 30' S	36° 2' E	Bluenose, White Sea	65° 21' N	38° 10' E
Beachy Head, England	50° 44' N	0° 15' E	Boca del Este, Cuba	20° 19' N	79° 8' W
Bear Isle, James' Bay	54° 34' N	79° 56' W	Bojador Cape, Luconia	18° 42' N	121° 0' E
Beauvais, France	49° 26' N	2° 5' E	Bojador Cape, West Coast of Africa ..	26° 12' N	14° 27' W
Beconia Isle, Caribbee Isles	13° 1' N	61° 16' W	Bolabola Island, Friendly Islands ..	16° 32' S	151° 52' W
Bedford's Cape, Davis's Straits	66° 55' N	68° 30' W	Bolcheritz, Kamtschatka	52° 54' N	156° 50' E
Belford (St.) Paul's Spire, England ..	52° 8' N	0° 28' W	Bolina Cape, Luconia	16° 27' N	120° 0' E
Bees (St.) Head Lighthouse, England	54° 31' N	3° 37' W	Bologna, Italy	44° 30' N	11° 21' E
Behring's Isle, Sea of Kamtschatka ..	55° 36' N	167° 46' E	Bomba Isle, Barbary	32° 22' N	23° 17' E
Belfast, Ireland	54° 35' N	5° 57' W	Bombay Lighthouse, India	18° 54' N	72° 56' E
Belfast Loch, Ireland	54° 43' N	5° 35' W	Bombay's Shoals, Chinese Sea	9° 26' N	116° 55' E
Belle Isle, Mount Lommara, France ..	47° 17' N	3° 5' W	Bombay's Shoal, S. W. End,	16° 0' N	112° 25' E
Belem Cape, Spain	43° 8' N	9° 12' W	Bolt Head, England	50° 13' N	3° 48' W
Belley, France	45° 45' N	5° 41' E	Bolus Head, Ireland	51° 50' N	10° 44' W
Bellona's Shoals, Centre, Pacific O ..	20° 55' S	159° 47' E	Bommel, Netherlands	51° 49' N	4° 55' E
Bembridge Point, Isle of Wight	50° 41' N	1° 5' W	Bommel Island (S. End), Norway ..	59° 32' N	5° 0' E
Bemisin Isles, W. Side, Lucayos	25° 36' N	79° 17' W	Bon Cape, Barbary	37° 5' N	11° 4' E
Bencoolen, Fort Marlboro', Sumatra ..	3° 48' S	102° 0' E	Bona, Barbary	36° 48' N	7° 49' E
Bender, Russia in Europe	46° 51' N	29° 36' E	Bonacio Island, N.E. Pt., B. of Hondu.	16° 33' N	86° 6' W
Bengasi, Barbary	32° 7' N	20° 2' E	Bonaventure Island, United States ..	48° 33' N	63° 48' W
Benguela Bay, West Coast of Africa ..	12° 33' S	13° 33' E	Bonavista Cape, Newfoundland	48° 42' S	52° 56' W
Benquieree, or Nelson I., C. of Egypt	31° 21' N	30° 39' E	Bonavista Isle, Eng. Rd., C. Verd Isles	16° 9' N	22° 57' W
Berdistan Cape, Persia	27° 58' N	51° 26' E	Bontokoe Island, Greenland	73° 15' N	7° 5' W
Bergamo, Italy	45° 42' N	9° 40' E	Bonifacio, Corsica	41° 23' N	9° 9' E
Bergen Castle, Norway	60° 24' N	5° 20' E	Boo Isles, Indian Archipelago	1° 12' S	129° 18' E
Bergen-op-Zoom, Netherlands	51° 30' N	4° 17' E	Boon Island, New Hampshire	43° 6' N	70° 31' W
Berkhampstead Tower, England	51° 45' N	0° 7' E	Boon Island Ledge, New Hampshire ..	43° 4' N	70° 27' W
Berlenga Isles, Watch Tower, Portugal	39° 25' N	9° 31' W	Boodroom, S.E. Tow. of Ft., Turkey ..	37° 1' N	27° 25' E
Berlin, Germany	52° 32' N	13° 22' E	Borchloen, Netherlands	50° 48' S	5° 21' E
Bermuda I. St. George's Tn., Atl. O ..	32° 22' N	64° 30' W	Bordeaux, France	44° 50' N	0° 34' W
—— Wreck Hill, Atl. O	32° 15' N	64° 47' W	Borgo, Russia	60° 21' N	25° 50' E
Bernard's (St.) Island, Friendly Islands	10° 51' S	167° 10' W	Borneo, Borneo	4° 55' N	114° 55' E
Berne, Switzerland	46° 57' N	7° 26' E	Bornholm Isle, Hammarshus, Bal. Sea	55° 18' N	14° 48' E
Berry Head, Flagstaff, England	50° 24' N	3° 28' W	Boscawen and Keppel Isles, P. Ocean	15° 53' S	175° 35' W
Berry Isles, Frozen Quay, Lucayos ..	25° 35' S	77° 42' W	Bostana Cape, Persia	26° 30' N	54° 52' E
—— N.W. Pt. Gr. Stirr. Qu., Lucayos	25° 49' N	77° 55' W	Boston, United States	42° 22' N	70° 59' W
Bertrand (St.), France	43° 1' N	0° 34' E	Boston Lighthouse, Massachusetts ..	42° 20' N	70° 54' W
Berwick (North) Law Staff, Scotland	56° 3' N	2° 42' W	Botany Bay, New South Wales	34° 0' S	151° 14' E
Berwick-upon-Tweed Spire, Scotland ..	55° 46' N	2° 0' W	Botol Tobago, Xima Isle, P. Ocean ..	21° 59' N	121° 48' E
Besancon, France	47° 14' N	6° 3' E	Bouca Isle, N. Point, Pacific Ocean ..	5° 0' S	154° 35' E
Bessted, Iceland	64° 6' N	21° 54' W	Bouhee, Friendly Islands	19° 34' S	174° 29' W
Beziers, France	43° 21' N	3° 13' E	Boulogne, France	50° 44' N	1° 37' E
Bickerton's Island, Pacific Ocean	18° 48' S	174° 48' W	Bounty Isles, Pacific Ocean	47° 35' S	179° 6' E
Biniapatam, Coromandel Coast	17° 57' N	83° 35' E	Bourbon Isle, St. Denys, Indian Ocean	20° 52' S	55° 30' E
Bilboa, Spain	43° 14' N	2° 44' W	Bourgas, Turkey in Europe	40° 14' N	26° 27' E

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Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Bourg de l'Ain, France	46° 12' N	5° 14' E	Byam-Martin Cape, Greenland	73° 32' N	77° 13' W
Bourges, France	47° 5' N	2° 24' E	Byron Cape, New Holland	28° 38' S	153° 37' E
Bougo Isle, Gajeli Bay, I. Archipelago 3	23° 127' 3" E				
Bouro Isle, Cajeli B., NW. Pt, I. Archip. 3	6° 125' 57" E		Cabrera Isle, the Middle, Mediter.	39° 7' N	3° 0' E
Boutin Point, Sachalin	51° 52' N	141° 48' E	Cader Idris Mountain, Wales	52° 42' N	4° 28' W
Bouton Isle, E. Point, Indian Ocean. 5	15° 123' 15" E		Cadiz Observatory, Spain	36° 32' N	6° 17' W
Bouton I., the Dome, Straits of Malac. 6	33° 99' 20" E		Caen, France	49° 11' N	0° 22' W
Bouvet's Isle, Atlantic Ocean	54° 16' S	6° 14' E	Caffa, Crimea	45° 6' N	35° 13' E
Bowen Port, N.W. Ent., New Holland 22	28° 150' 45" E		Cagayanes Isles, Philippine Isles	9° 34' N	121° 23' E
Bow Island, Pacific Ocean	18° 17' S	140° 43' W	Cagayanes Soo.oo Isle, Chinese Sea . 7	0° 118' 36" E	
Bowling-Green Cape, New Holland . . .	19° 23' S	147° 25" E	Cagliari, Sardinia	39° 13' N	9° 6' E
Bozzolo, Italy	45° 6' N	10° 30' E	Cahors, France	44° 26' N	1° 27' E
Brachy Pool Head, England	52° 47' N	4° 37' W	Caiman I. (Little), W. End, Carib. Sea	19° 37' N	80° 1' W
Bradwell Point Flagstaff, England . . .	51° 44' N	0° 56' E	Cairo, Egypt	30° 28' N	31° 19' E
Brandenburg, Germany	52° 27' N	12° 53' E	Cajaneburg, Russia in Europe	64° 13' N	27° 45' E
Brassa Sound Lerwick, Shetl. Islands 60	11° 1' 0" W		Calais, France	50° 58' N	1° 51' E
Braunau, Germany	48° 14' N	12° 57' E	Calcutta, India	22° 34' N	88° 26' E
Brava, East Coast of Africa	1° 8' N	44° 10' E	Calicut, India	11° 15' N	76° 5' E
Bray Head, Ireland	51° 56' N	10° 50' W	Callao Port, the Castle, Peru	12° 4' S	77° 4' W
Breda, Netherlands	51° 35' N	4° 47' E	Calmar, Sweden	56° 40' N	16° 26' E
Bregançon Fort, France	43° 5' N	6° 19' E	Calmez Cape, Nubia	21° 28' N	37° 25' E
Bregentz, Germany	47° 30' N	9° 44' E	Canary (N.E. Point,) Teneriffe	28° 13' N	15° 38' W
Brehat Island, France	48° 50' N	2° 56' W	Calpy, India	26° 7' N	80° 0' E
Bremén, Germany	53° 5' N	8° 48' E	Calvi, Corsica	42° 34' N	8° 45' E
Brescia, Italy	45° 32' N	10° 14' E	Calmere Point, India	10° 18' N	79° 58' E
Brescou, France	43° 15' N	3° 27' E	Camarones River, W. Coast of Africa 3	15° 9' 0" N	
Breslaw, Germany	51° 6' N	17° 2' E	Cambing Isle, S. Point, I. Archipelago 8	21° 125' 39" E	
Brest, France	48° 23' N	4° 29' W	Cambray, France	50° 11' N	3° 14' E
Bridgewater Spire, England	51° 8' N	3° 0' W	Cambridge, Gt. St. Mary's Steep., Eng.	52° 13' N	0° 8' E
Briel, Netherlands	51° 54' N	4° 10' E	Cambayna I., the Peak, I. Archipelago 5	21° 122' 1" E	
Brieuc (St.), France	48° 31' N	2° 44' W	Camerino, Italy	43° 6' N	13° 24' E
Brighthelmstone Church, England . . .	50° 50' N	0° 10' W	Cameron Cape, Mexico	16° 0' N	85° 12' W
Brill Rock, Indian Archipelago	6° 5' S	118° 51' E	Cameron's River, Congo	3° 30' N	9° 55' W
Brindisi, Gulf of Venice	40° 36' N	18° 12' E	Camfidia, Arabia	19° 7' N	40° 50' E
Bristol Cathedral, England	51° 27' N	2° 35' W	Caminha, Portugal	41° 52' N	8° 45' W
Brixen, Germany	46° 40' N	11° 37' E	Campbell Cape, New Zealand	41° 34' S	174° 56' E
Broad Haven, Ireland	54° 26' N	10° 12' W	Campeche, Mexico	19° 51' N	90° 30' W
Brocken Mountain, Germany	51° 48' N	10° 37' E	Cananore, India	11° 51' N	75° 44' E
Bronage, France	45° 52' N	1° 4' W	Canary Isle (Grand) Palma, Canaries .	28° 10' N	15° 31' W
Broyle Cape, Newfoundland	47° 8' N	52° 35' W	Candia, Candia	35° 19' N	25° 18' E
Bruck, Germany	47° 25' N	15° 16' E	Candinos Cape, White Sea	68° 39' N	44° 35' E
Bruges, Netherlands	51° 13' N	3° 14' E	Candlemas Isles, Sandwich Land . . .	57° 10' N	27° 13' W
Brunn, Germany	49° 11' N	16° 35' E	Candu Isles, Maldives	6° 0' S	76° 35' E
Brunswick, Germany	52° 16' N	10° 32' E	Canea, Candia	35° 29' N	24° 13' E
Brunswick House, New Wales	50° 14' N	82° 39' W	Cansau Harbour, Nova Scotia	45° 20' N	60° 55' W
Bruquen Point, Porto Rico	18° 31' N	67° 12' W	Canso, Gut of, United States	45° 44' N	61° 31' W
Brussels, Netherlands	50° 51' N	4° 22' E	Canterbury Cathedral, England	51° 17' N	1° 5' E
Bruster Ort Lights, Prussia	54° 52' N	19° 55' E	Cantin Cape, Africa	32° 33' N	9° 15' W
Bucarelli Point, N. W. C. of America 55	12° 133' 25" W		Canton, China	23° 8' N	113° 3' E
Buchan Ness, Scotland	57° 30' N	1° 47' W	Canton Isle, Chinese Sea	15° 23' N	109° 6' E
Bucharest, Wallachia	44° 27' N	26° 8' E	Canzir Cape, Syria	36° 18' N	35° 40' E
Buckingham Spire, England	52° 0' N	0° 59' W	Cape Griz Nez, France	50° 52' N	1° 34' E
Buda, Hungary	47° 30' N	19° 2' E	Cape-Digges Isle, Hudson's Bay	62° 41' N	78° 50' W
Buenos Ayres, Paraguay	34° 37' S	58° 24' W	Cape de Caux, France	49° 41' N	0° 11' E
Buga, Terra Firma	3° 55' N	76° 22' W	Cape Cornwall, England	50° 10' N	5° 49' W
Burgeon Isles, Newfoundland	47° 35' N	57° 36' W	Capones Point, Luconia	14° 52' N	120° 3' E
Burgos, Spain	42° 21' N	2° 40' W	Capraja Isle, Mediterranean	43° 0' N	9° 48' E
Burhampour, India	21° 19' N	76° 22' E	Caprera Isle, Mediterranean	41° 13' N	9° 28' E
Burica Point, Mexico	8° 4' N	82° 50' W	Capricorn Cape, New Holland	23° 28' S	151° 15' E
Burlings, Portugal	39° 25' N	9° 31' W	Caracas, Terra Firma	10° 31' N	67° 5' W
Burning Isle, Indian Archipelago . . .	6° 35' S	126° 40' E	Carcassonne, France	43° 13' N	2° 21' E
Burrow Head, England	54° 41' N	4° 16' W	Cardigan Isle, Highest Point, Wales .	52° 8' N	4° 40' W
Bushier, Persia	29° 0' N	50° 56' E	Cargados Garajos Isles, N. I., Indian O.	16° 18' S	59° 41' E
Bussora, the Factory, Turkey in Asia 30	29° 47' 40" N		Cariman Java Isle, Indian Archipelago 5	50° 50' S	101° 34' E
Buttacoli Roads, Ceylon	7° 44' N	81° 52' E	Carimata Isle, Peak, I. Archipelago . .	1° 37' S	108° 53' E
Butt of Lewis, Lewis Isles	58° 29' N	6° 12' W	Carlingford Loch, Ireland	54° 0' N	6° 4' W
Button Ness Light, Scotland	56° 28' N	2° 45' W	Carlisle, England	54° 54' N	2° 46' W
Button Isle, Hudson's Straits	60° 35' N	65° 20' W	Carlos (St.), Terra Firma	1° 54' N	67° 38' W
Buzzard's Bay Ent., United States . . .	41° 28' N	70° 58' W	Carlos (St.) Port, Chili	41° 52' S	73° 53' W

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Carlota, Spain.....	37° 40' N	4° 57' W	Cette Lighthouse, France.....	43° 24' N	3° 41' E
Carlsburg, Hungary.....	46° 4' N	23° 34' E	Ceuta Fort, Barbary.....	35° 54' N	5° 17' W
Carlskrona, Sweden.....	56° 7' N	15° 33' E	Chain Isle, Pacific Ocean.....	17° 25' S	145° 30' W
Carlshamn, Sweden.....	56° 11' N	14° 51' E	Chaleur Bay Entrance, United States	48° 4' N	64° 14' W
Carlo Great Isle, Baltic Sea.....	57° 19' N	18° 0' E	Chalons-sur-Marne, France.....	48° 57' N	4° 22' E
Carmarthen, W. End, England.....	51° 51' N	4° 19' W	Chalons-sur-Saone, France.....	46° 47' N	4° 51' E
Carmel Cape, Syria.....	32° 51' N	35° 0' E	Chandernagore, India.....	22° 51' N	88° 29' E
Carmen Isle, N. Point, Glf. of Mexico	18° 52' N	91° 23' W	Chansely Cape (St.) Pedro, Arabia..	18° 2' N	56° 27' E
Carmona, Spain.....	37° 28' N	5° 40' W	Chapel Rock, Atlantic Ocean.....	47° 28' N	7° 30' W
Carnicobar Isle, Bay of Bengal.....	9° 10' N	92° 56' E	Charlton Island, Hudson's Bay.....	52° 3' N	79° 55' W
Carnsore Point, Ireland.....	52° 11' N	6° 19' W	Charleston Light, United States.....	32° 43' N	79° 46' W
Carolina, Spain.....	38° 17' N	3° 36' W	Charkou, Russia in Europe.....	50° 0' N	36° 27' E
Carpentras, France.....	44° 3' N	5° 3' E	Charles Cape, Labrador.....	62° 46' N	74° 15' W
Carpio, Spain.....	37° 57' N	4° 29' W	Charles Cape, United States.....	37° 12' N	75° 45' W
Carraccas, Carraccas.....	10° 30' N	66° 57' W	Chartres, France.....	48° 27' N	1° 29' E
Carrickfergus, Ireland.....	54° 43' N	5° 45' W	Chassiron Tower, France.....	46° 3' N	1° 24' W
Carthagena, Spain.....	37° 36' N	1° 0' W	Chatal Isle, N.E. Peak, Archipelago	37° 0' N	27° 12' E
Carthagena, Terra Firma.....	10° 25' N	75° 30' W	Chatham Isle, C. Young, Pacific O..	43° 48' S	176° 58' W
Carvoeira Cape, Lighthouse, Portugal	39° 21' N	9° 25' W	Chatham Isle, E. Point, Pacific O..	0° 46' S	89° 57' W
Carwar Head, Malabar Coast.....	14° 47' N	74° 12' E	Cheduba Island, N.W. Pt., B. of Beng.	18° 58' N	93° 18' E
Carysfoot Isle, Pacific Ocean.....	21° 0' S	138° 26' W	Chelidonia Cape, Turkey in Asia.....	36° 12' N	30° 26' E
Casal-Maggiore, Italy.....	44° 59' N	10° 26' E	Chelmsford, England.....	51° 44' N	0° 28' E
Casbin, Persia.....	36° 11' N	49° 33' E	Cheltenham Steeple, England.....	51° 54' N	2° 4' W
Casket Lights, France.....	49° 44' N	2° 26' W	Cherbourg, France.....	49° 38' N	1° 37' W
Cassel, Germany.....	51° 19' N	9° 35' E	Cherry Island, Pacific Ocean.....	11° 31' S	169° 39' W
Castelnaudari, France.....	43° 19' N	1° 53' E	Cherson, Russia in Europe.....	46° 38' N	32° 39' E
Castel-Tornese, Morea.....	37° 54' N	21° 10' E	Chesterfield Shoal, Madagascar Chan.	16° 15' S	44° 0' E
Castiglione Fort, Italy.....	42° 46' N	10° 52' E	Chester, Trinity Spire, England.....	53° 11' N	2° 53' W
Castillo Point, Mexico.....	15° 58' N	86° 11' W	Chicacole, Coromandel Coast.....	18° 27' N	84° 0' E
Castletown, Isle of Man.....	54° 3' N	4° 35' W	Chichester Spire, England.....	50° 50' N	0° 47' W
Castle Isle, Lucayos.....	22° 7' N	74° 18' W	Chiloe Isle, St. Carlos, Chili.....	41° 53' S	72° 55' W
Castres, France.....	43° 37' N	2° 15' E	Chin-chew Bay, China.....	24° 54' N	118° 40' E
Castries Bay, Tartary.....	51° 29' N	140° 56' E	Chipiona Point, Spain.....	36° 44' N	6° 24' W
Cat Island N. Point, Lucayos.....	24° 37' N	75° 50' W	Chiquinquira, Terra Firma.....	5° 32' N	74° 14' W
Catania Mole, Sicily.....	37° 28' N	15° 4' E	Christchurch Head, England.....	50° 43' N	1° 45' W
Catastrophe Cape, New Holland.....	35° 0' S	135° 54' E	Christian Sound, Lapland.....	63° 11' N	7° 30' E
Catherinburg, Russia in Asia.....	56° 51' N	60° 40' E	Christiana Isle, Archipelago.....	36° 15' N	25° 4' E
Catherine's (St.) Isle, Mediterranean..	35° 52' N	27° 40' E	Christiana, Norway.....	59° 55' N	10° 48' E
Catherine's (St.) I., Atomey I., Brazil	27° 52' S	48° 0' W	Christiansand, Norway.....	58° 8' N	8° 3' E
Catherine's (St.) Lighth., I. of Wight.	50° 36' N	1° 18' W	Christiansfeld, Denmark.....	55° 22' N	9° 29' E
Catoch Cape, Mexico.....	21° 31' N	86° 57' W	Christiansstad, Sweden.....	56° 1' N	14° 9' E
Cato's Bank, dry part, Pacific Ocean.	23° 6' S	155° 23' E	Christiansund, Norway.....	63° 7' N	7° 42' E
Catwyk-op-zee, Netherlands.....	52° 12' N	4° 24' E	Christinaestad, Russia in Europe.....	62° 16' N	21° 18' E
Cavallon, France.....	43° 50' N	5° 2' E	Christmas Harbour, Tierra del Fuego	55° 22' S	69° 47' W
Cavaliere Cape, Turkey in Asia.....	36° 38' N	33° 43' E	Christmas Isle, Indian Ocean.....	10° 34' S	105° 33' E
Cavan, Ireland.....	53° 52' N	7° 25' W	Christmas Isle, Pacific Ocean.....	1° 58' N	157° 35' W
Caxa-de-Muertos Isle, Porto Rico.....	17° 50' N	66° 38' W	Christopher's (St.) I., Mozambique..	17° 2' S	43° 9' E
Caxamarca, Peru.....	7° 9' S	78° 35' W	Christopher (St.) I. Basseterre, Carib.	17° 19' N	62° 49' W
Caxones (W. Point.) Mosquitos.....	16° 28' N	83° 11' W	Christoval (St.) I. Survall C., Solom.	11° 50' S	162° 22' E
— (S.E. Point.) Mosquitos.....	15° 41' N	82° 27' W	Christoval (Don) Quay, Cuba.....	22° 10' N	82° 1' W
Cayenne, Guayana.....	4° 56' N	52° 15' W	Chulawan Isle, E. Coast of Africa..	20° 36' S	35° 4' E
Caymanbrack (E. P.), Cuba.....	19° 43' N	79° 32' W	Chusan Harbour, Chusan, China.....	30° 26' N	121° 41' E
Caymen (Great) Island, Sea of Cuba..	19° 12' N	81° 26' W	Cilly, Germany.....	46° 40' N	15° 25' E
Cayques Bank, S.E. Point, Lucayos..	21° 2' N	71° 32' W	Cimbritzhamn, Sweden.....	55° 33' N	14° 21' E
— N.E. Pt. of Gr. Cay., L. 21	43° N	71° 24' W	Ciotat (la), France.....	43° 10' S	5° 37' E
— N. Pt. of N. Cay., L. 21	57° N	71° 56' W	Civita Vecchia, Italy.....	42° 5' N	11° 45' E
— S. Pt. of W. Cay., L. 21	31° N	72° 27' W	Clackton (Great) Signal Staff, Eng.	51° 48' N	1° 12' E
Cedar Inlet, Maryland.....	34° 47' N	76° 22' W	Clagenfurt, Germany.....	46° 37' N	14° 20' E
Cedeira Port, Pantin Isle, Spain.....	43° 41' N	7° 59' W	Clara (St.) Isle, Japan.....	30° 45' N	129° 54' E
Cefalonia Isle, C. Viscardo, Mediter.	38° 27' N	20° 33' E	Clare, Ireland.....	52° 51' N	9° 32' W
Cefalu Cathedral, Sicily.....	38° 0' N	14° 3' E	Claude (St.), France.....	46° 23' N	5° 52' E
Ceicer-de-Mer Isle, Chinese Sea.....	10° 32' N	108° 53' E	Clausthal, Germany.....	51° 48' N	10° 21' E
Ceicer-de-Terre Isle, Chinese Sea.....	11° 13' N	108° 51' E	Clear Cape, Ireland.....	51° 25' N	9° 29' W
Celebes (S. Point.) Indian Ocean.....	5° 46' S	120° 0' E	Clerke's Isle, Sea of Kamtschatka..	63° 15' N	169° 40' W
Ceram Isle E. Point, Ind. Archipelago	3° 55' S	130° 40' E	Clerke's Rocks, Atlantic Ocean.....	55° 5' S	34° 42' W
— S.W. Point, I. Archipelago.....	3° 31' S	127° 56' E	Clermont, France.....	49° 23' N	2° 25' E
Cerigo Isle, S. Point, Mediterranean..	36° 6' N	22° 52' E	Clermont-Ferrand, France.....	45° 47' N	3° 5' E
Cerowa Isle, Indian Archipelago.....	6° 10' S	129° 53' E	Cleavelands Shoal, W. Coast of Africa	30° 45' N	10° 21' W
Cervia, Italy.....	44° 16' N	12° 20' E	Cleves, Germany.....	51° 48' N	6° 7' E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Cloates Island, Indian Ocean	22° 8' S	112° 30' E	Cracatoa Isl., Straits of Sunda	6° 6' S	105° 30' E
Clyth Ness, Scotland	58° 20' N	3° 16' W	Cracow, Galicia	50° 4' N	19° 57' E
Cobourg, Germany	50° 15' N	10° 58' E	Crail Spire, Scotland	56° 16' N	2° 37' W
Coche Isle, W. Point, Caribbee Sea.	10° 47' N	64° 5' W	Crema, Italy	45° 21' N	9° 42' E
Cochin, India	9° 57' N	76° 29' E	Cremona, Italy	45° 8' N	10° 2' E
Cocos Isle, Indian Ocean	3° 6' N	95° 12' E	Cremsmunster, Germany	48° 3' N	14° 8' E
Cocos Isles, N. Isle, Indian Ocean	11° 50' S	97° 4' E	Crescent Island, Pacific Ocean	23° 22' S	134° 30' W
Cod Cape Light, United States	42° 3' N	70° 6' W	Creux Cape, Spain	42° 20' N	3° 21' E
Cod's Head, Ireland	51° 42' N	10° 27' W	Crillon Cape, Sachalin	45° 56' N	141° 59' E
Codera Cape, Terra Firma	10° 35' N	66° 11' W	Croisic, France	47° 18' N	2° 30' W
—Terra Firma	10° 36' N	65° 58' W	Cromer Light, England	52° 55' N	1° 20' E
Coetivy Isle, Indian Ocean	7° 14' S	56° 32' E	Cromer Bank, England	53° 11' N	1° 35' E
Coffin Island, Mozambique	17° 30' S	44° 4' E	Cronstadt, Russia in Europe	59° 59' N	29° 49' E
Coimbra, Portugal	40° 12' N	8° 25' W	Crookhaven, Ireland	51° 24' N	9° 52' W
Colchester, St. Mary's, England	51° 53' N	0° 54' E	Crooked Isle, W. End, Lucayos	22° 48' N	74° 17' W
Collioure, France	42° 32' N	3° 5' E	Croque Harbour, Newfoundland	51° 3' N	55° 53' W
Colnet Cape, New Caledonia	20° 30' S	164° 56' E	Cross Fell, England	54° 42' N	2° 29' W
Cologne, Germany	50° 55' N	6° 55' E	Cross Isle, Russia in Europe	66° 29' N	40° 20' E
Colombo, Ceylon	6° 57' N	80° 0' E	Cross Sound, Ent., N.W. C. of Amer.	58° 12' N	136° 24' W
Colombretta Isle, Spain	39° 56' N	4° 0' E	Crotuy, France	50° 13' N	1° 38' E
Colonia Sacramento, Paraguay	34° 26' S	57° 58' W	Cruz Cape, Cuba	19° 48' N	77° 35' W
Columbia R., Ent., N.W. C. of Amer.	46° 19' N	123° 54' W	Cruz del Padre Quay, Lucayos	23° 14' N	81° 4' W
Combay Isle, Indian Archipelago	7° 49' S	123° 41' E	Cuba, Cuba	19° 57' N	76° 4' W
Comfort Cape, Greenland	61° 55' N	49° 26' W	Cucau Mountain, Chili	42° 45' S	74° 6' W
Commachio, Italy	44° 40' N	12° 10' E	Cuddalore, India	11° 43' N	79° 48' E
Como, Italy	45° 48' N	9° 6' E	Cuenca, Peru	2° 55' S	79° 13' W
Comoriu Cape, India	8° 5' N	77° 44' E	Culebra Isle, Caribbee Isles	18° 21' N	65° 26' W
Comoro Isle, Comoro Isles	11° 32' S	43° 25' E	Fullera Cape, Spain	39° 9' N	0° 11' W
Conception, Chili	36° 49' S	73° 5' W	Culpepper's Island, Gallopogas Isles	1° 40' N	91° 55' W
Conchée Tower, France	48° 41' N	2° 3' E	Culver Point, New Holland	32° 56' S	124° 39' E
Conclusion Port, N.W. C. of America	56° 15' N	134° 23' W	Cumana, Terra Firma	10° 28' N	64° 10' W
Condom, France	43° 58' N	0° 22' E	Cumbava Island (S.W. P.), Java Sea	8° 54' S	116° 47' E
Condore Isle, Centre, I. Archipelago	8° 40' N	106° 42' E	Cumberland House, New Wales	53° 57' N	102° 6' W
Confites Quay, Lucayos	22° 12' N	77° 44' W	Cummin Isle, China	31° 40' N	121° 41' E
Congo River, Congo	6° 10' S	11° 15' E	Cura, Terra Firma	10° 3' N	67° 45' W
Congoon, Persia	27° 49' N	52° 6' E	Curaçao I. Ent. of Amst. H. Carib. Sea	12° 8' N	69° 0' W
Constance, Germany	47° 36' N	9° 8' E	Curreuse Island, Indian Ocean	4° 10' S	55° 45' E
Constantinople, St. Sophia, Tur. in Eu.	41° 1' N	28° 55' E	Curciacou Island, Caribbee Isles	12° 30' N	61° 31' W
Cope Cape, Spain	37° 25' N	1° 32' W	Cuxhaven Lighthouse, Germany	53° 52' N	8° 43' E
Copenhagen, Denmark	55° 41' N	12° 35' E			
Copiapó, Chili	27° 10' S	71° 5' W	Dagelet Isle, Sea of Japan	37° 22' N	130° 57' E
Copinska, Orkney Islands	58° 56' N	2° 48' W	Dagerort Point, Russia in Europe	58° 56' N	22° 9' E
Coquimbo, Chili	29° 55' S	71° 19' W	Dale Point, New Holland	11° 42' S	136° 3' E
Cordova Port, Patagonia	45° 45' S	67° 27' W	Dalrymple Cape, Sachalin	48° 21' N	142° 50' E
Cordovan Tower, France	45° 35' N	1° 10' W	Dalrymple Port, Van Dieman's Land	41° 4' S	146° 48' E
Corfu Isle, Vido Isle, Mediterranean	39° 38' N	19° 56' E	Dame Marie Cape, St. Domingo	18° 39' N	74° 20' W
Coringa Bay, Gordeware Point, India	16° 48' N	82° 21' E	—St. Domingo	18° 37' N	74° 34' W
Corinth, Turkey in Europe	37° 58' N	23° 28' E	Damietta, Egypt	31° 26' N	31° 49' E
Cork, Quay at the Cove, Ireland	51° 52' N	8° 16' W	Damme, Germany	52° 32' N	8° 12' E
Cornacchitti Cape, Cyprus	35° 24' N	32° 57' E	Danger Isles, Centre, Pacific Ocean	10° 51' S	167° 50' W
Corn Island, Great, Caribbean Sea	12° 13' N	82° 10' W	Dantzic, Prussia	54° 21' N	18° 38' E
Cornwallis Group, Pacific Ocean	44° 37' S	175° 26' W	Danville Cape, Japan	31° 28' N	131° 27' E
Coronation Cape, New Caledonia	22° 5' S	167° 8' E	Darby Cape, N.W. Coast of America	64° 21' N	163° 0' W
Coron, Turkey in Europe	36° 47' N	21° 59' E	Dardanelles, Old Castle, Turkey in A.	40° 9' N	26° 19' E
Corrientes Cape, Cuba	21° 44' N	84° 29' W	Darmstadt, Germany	49° 56' N	8° 35' E
Corrientes Cape, E. Coast of Africa	24° 1' S	35° 51' E	Dassen Island, S.W. Coast of Africa	33° 24' S	18° 3' E
Corrientes Cape, Terra Firma	5° 33' N	77° 16' W	Dauphin Port, Madagascar	25° 5' S	46° 35' E
Corse Cape, Corsica	43° 3' N	9° 23' E	Dayentry Spire, England	52° 16' N	1° 9' W
Corsoer, Denmark	55° 20' N	11° 9' E	David's (St.) Isles, Centre, Pacific O.	0° 55' N	134° 21' E
Corte, Corsica	42° 18' N	9° 9' E	David's (St.) Head, Wales	51° 54' N	5° 17' W
Corvo Isle, S. Point, Azores	39° 41' N	31° 3' W	David's Inlet Entrance, Labrador	55° 48' N	60° 12' W
Corunna, Spain	43° 23' N	8° 19' W	Dax, France	43° 42' N	1° 3' W
Cosmeledo Isles, Indian Ocean	9° 45' S	48° 40' E	Deadman's Head, England	50° 13' N	4° 47' W
Coudres Isle, Canada	47° 23' N	70° 23' W	De Bas Island, France	48° 46' N	4° 2' W
Courtray, Netherlands	50° 50' N	3° 16' E	Deal Castle, England	51° 13' N	1° 24' E
Coutances, France	49° 3' N	1° 26' W	Deception Cape, Solomon Isles	8° 21' S	157° 2' E
Cove Point, United States	38° 17' N	76° 26' W	Delagoa B., St. Mary's I. Africa	25° 58' S	33° 15' E
Coventry, St. Martin's Spire, England	52° 24' N	1° 30' W	Delft, Netherlands	52° 1' N	4° 22' E
Cozumbe Isle, S. Point, Bay of Hond.	19° 50' N	86° 40' W	Delgado Cape (North), E. C. of Africa	0° 0' N	51° 17' E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Delgado Cape (South), E. C. of Africa	10° 6'S	40° 50'E	Doro Cape, Negropont	38° 9'N	24° 20'E
Delhi, India	28° 37'N	77° 40'E	Dorpat, Russia in Europe	58° 23'N	26° 42'E
Deliverance Cape, Louisiade	10° 59'S	154° 26'E	Dortmund, Germany	51° 31'N	7° 27'E
De Galle Point, Ceylon	6° 4'N	80° 19'E	Double Island Point, New Holland	25° 56'S	153° 13'E
De Gratt Cape, Newfoundland	51° 40'N	55° 30'W	Douglas Cape, N.W. Coast of America	58° 56'N	153° 50'W
Della Estaca Point, Spain	43° 48'N	7° 36'W	Dover Castle, England	51° 8'N	1° 19'E
Dela Vela Cape, Terra Firma	12° 18'N	71° 50'W	Dresden, Germany	51° 3'N	13° 43'E
Delmennorst, Germany	53° 3'N	8° 39'E	Dromedary Mount, New Holland	36° 18'S	150° 11'E
Delos Islands Factory, Senegambia	9° 22'N	13° 32'W	Drontheim, Norway	63° 26'N	10° 23'E
Denbigh Cape, Behring's Straits	64° 17'N	161° 53'W	Druja, Russia in Europe	55° 47'N	27° 14'E
Dendera, Egypt	26° 10'N	32° 40'E	Dublin Observatory, Ireland	53° 23'N	6° 20'W
Dengeness Lighthouse, England	50° 55'N	0° 58'E	— Pier Lighthouse, Ireland	53° 21'N	6° 5'W
D'Entrecasteaux Point, New Holland	34° 52'S	116° 1'E	Ducies Island, Pacific Ocean	24° 40'S	124° 37'W
Denys Cape, Louisiade	8° 24'S	151° 4'E	Duke-of-York's Isle, Pacific Ocean	8° 41'S	173° 25'W
Derby Steeple, England	52° 56'N	1° 28'W	Dulau Signal Staff, England	55° 56'N	2° 13'W
Desconocida Point, Mexico	20° 49'N	90° 23'W	Dundee, Scotland	56° 25'N	3° 2'W
Deseada Isle, N.E. Point, Caribbee I.	16° 20'N	61° 2'W	Dunkirk, France	51° 2'N	2° 23'E
Desert Isles, Indian Ocean	48° 5'S	48° 0'E	Dunmore Head, Ireland	52° 13'N	10° 54'W
Desolation Cape, Greenland	60° 58'N	49° 0'W	Dunnose, Isle of Wight	50° 37'N	1° 12'W
Despair Cape, United States	48° 27'N	63° 57'W	Dunstanbrough Castle, England	55° 30'N	1° 35'W
De Tierra Island, Pacific Ocean	33° 45'S	78° 51'W	Durazzo, Turkey in Europe	41° 19'N	19° 27'E
Desvelos (los) Cape, Patagonia	48° 21'S	66° 8'W	Durham Cathedral, England	54° 47'N	1° 34'W
Devil's Hill, W. Coast of Africa	5° 19'N	0° 32'W	Durours Island, Louisiade Isles	1° 17'S	143° 30'E
Devil's Rocks, Atlantic Ocean	46° 25'N	13° 0'W	Dursey Isle Tower, Ireland	51° 35'N	10° 14'W
Devil's Isles, Plantain Isle, Guayana	5° 27'N	52° 34'W	Dusseldorf, Germany	51° 14'N	6° 46'E
Dezertos S. Point, Atlantic Ocean	32° 22'N	16° 28'W	Duyfhen Cape, New Holland	12° 35'S	141° 42'E
Dhalac Isle, S. End, Red Sea	15° 32'N	40° 15'E	Dwalder Isle, Indian Archipelago	4° 12'S	116° 21'E
Diamond Isle, Bay of Bengal	15° 52'N	94° 19'E	Dysburg, Germany	51° 26'N	6° 46'E
Diamond Point, Sumatra	5° 18'N	97° 48'E			
Diarbekir, Turkey in Asia	37° 54'N	39° 54'E	Eartholms, Baltic Sea	55° 19'N	15° 15'E
Die, France	44° 46'N	5° 23'E	East Cape, Madagascar	15° 14'S	50° 30'E
Diego (St.), New Albion	32° 39'N	117° 17'W	East Cape, New Zealand	37° 44'S	178° 58'E
Diego Garcia I. Flagstaff Pt., I. Ocean	7° 21'S	72° 22'E	East Cape, Russia in Asia	66° 5'N	169° 44'W
Diego Ramirez I. Mid. I., Tierra del F.	56° 27'S	68° 39'W	Easter Isle, Centre, Pacific Ocean	27° 10'S	109° 25'W
Diepholtz, Germany	52° 36'N	8° 21'E	East-Main House, Labrador	52° 15'N	78° 44'W
Dieppe, France	49° 56'N	1° 5'E	Ebersdorf, Germany	50° 30'N	11° 40'E
Dieu Head, India	20° 42'N	71° 6'E	Ebro R. Entrance, Spain	40° 42'N	0° 57'E
Dieu Island, W. Point, France	46° 42'N	2° 27'W	Edam, Netherlands	52° 31'N	5° 3'E
Diez (St.), France	48° 17'N	6° 57'E	Eddystone Isle, Solomon Isles	8° 18'S	156° 31'E
Diggis Cape, Hudson's Bay	62° 41'N	78° 50'W	Eddystone Lighthouse, England	50° 11'N	4° 15'W
Digne, France	44° 5'N	6° 14'E	Edgecumbe Cape, N.W. C. of Amer.	57° 2'N	135° 46'E
Dijon, France	47° 19'N	5° 2'E	Edinburgh, Scotland	55° 57'N	3° 12'W
Dillingen, Germany	48° 34'N	10° 30'E	Egg Isle, Lucayos	25° 31'N	76° 53'W
Dilly Mount, India	11° 59'N	75° 31'E	Egmont Port, Anchorage, Falkland I.	51° 21'S	60° 1'W
Direction Isle, Indian Archipelago	10° 55'N	108° 10'E	Eichstadt, Germany	48° 53'N	11° 10'E
Disappointment Cape, South Georgia	54° 58'S	36° 15'W	Eisenach, Germany	50° 59'N	10° 20'E
Disappointment Island, Pacific Ocean	9° 57'S	167° 0'E	El-Arisch Fort, Egypt	31° 5'N	33° 48'E
Disappointment Isles, Pacific Ocean	14° 7'S	141° 22'W	Elba Isle, Porto-Ferrajo, Mediterran.	42° 49'N	10° 20'E
Discord Cape, Greenland	60° 27'S	43° 20'W	Elbing, Prussia	54° 8'N	19° 22'E
Disco Isle, Leifde Bay, Baffin's Bay	69° 10'N	54° 40'W	Elbingerode, Germany	51° 47'N	10° 48'E
Discovery Port, N.W. Coast of Amer.	48° 2'N	122° 38'W	Eleuthera Island, Powell's P., Lucayos	24° 37'N	76° 22'W
Discovery's Shoal, S.W. End, Paracels	16° 12'N	111° 33'E	Elias (St.) Mount, N.W. C. of Amer.	60° 18'N	140° 50'W
Divy Point, India	15° 59'N	81° 16'E	Elizabeth (St.), Russia in Europe	48° 30'S	32° 28'E
Dixmude, Netherlands	51° 2'N	2° 52'E	Elizabeth Bay, W. Coast of Africa	27° 0'S	15° 17'E
Dobrzyn, Russia in Europe	52° 38'N	19° 35'E	Elizabeth Cape, Sachalin	54° 24'N	142° 46'E
Dofar, Arabia	17° 3'N	54° 10'E	El-Mellah Cape, Barbary	31° 57'N	25° 5'N
Dol, France	44° 33'N	1° 45'W	Elseneur, Denmark	56° 2'N	12° 38'E
Domar Isle, Indian Archipelago	2° 45'N	105° 27'E	Elsfleet, Germany	53° 11'N	8° 26'E
Domburg, Netherlands	51° 34'S	3° 30'E	Ely Minster, England	52° 25'N	0° 17'E
Domesness Lights, Prussia	57° 46'N	22° 30'E	Embrun, France	44° 34'N	6° 26'E
Domingo (St.), St. Domingo	18° 30'N	69° 49'W	Emden, Germany	53° 22'N	7° 11'E
— St. Domingo	18° 29'N	70° 0'W	Emeralda, Terra Firma	3° 11'N	66° 3'W
Dominica Isle, Roseau, Caribbee Isle	15° 18'N	61° 32'W	Emmerick, Germany	51° 50'N	6° 15'E
Donda Cape, Celebes	0° 48'N	119° 57'E	Enare, Lapland	68° 56'N	27° 15'E
Dondre Head, Ceylon	5° 55'N	80° 43'E	Enatum Island, New Hebrides	20° 10'S	170° 4'N
Dondrekin Isle, S. Point, Ind. Arch.	0° 54'S	117° 36'E	Endeavour River, Ent, New Holland	15° 25'S	145° 26'E
Donnawert, Germany	48° 43'N	10° 47'E	Engano Cape, Luconia	18° 39'N	122° 21'E
Dorchester Church, England	50° 43'N	2° 26'W	Engano Cape, St. Domingo	18° 35'N	68° 25'W
Dordrecht, Netherlands	51° 49'N	4° 40'E	Engano Isle, Indian Ocean	5° 27'S	102° 17'E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Engelholm, Sweden	56° 14' N	12° 52' E	Flamborough Head, England	54° 8' N	0° 2' W
Enkhuysen, Netherlands	52° 42' N	5° 18' E	Flat Point, New Guinea	0° 46' S	134° 25' E
Enos, Turkey in Europe	40° 42' N	25° 59' E	Flat Point, Sumatra	6° 0' S	104° 40' E
Boaa Island, Friendly Isles	21° 24' S	174° 30' W	Flatholms Lighthouse, Bristol Channel	51° 23' N	3° 6' W
Epiphanes (St.) Cape, Cyprus	35° 28' N	32° 7' E	Flattery Cape, N.W. Coast of America	48° 23' N	124° 22' W
Erdingen, Germany	48° 18' N	11° 55' E	Fleckerøe Isle, Norway	58° 5' N	8° 2' E
Eregri, Turkey in Asia	41° 18' N	31° 27' E	Flensborg, Denmark	54° 47' N	9° 28' E
Erfurth, Germany	50° 59' N	11° 2' E	Florence, Italy	43° 47' N	11° 16' E
Erlangen, Germany	49° 36' N	11° 4' E	Flores Isle, Azores	39° 34' N	31° 8' W
Erromanga Isle, New Hebrides	18° 46' S	168° 58' E	Flores Isle, N.E. Pt., Indian Archip.	8° 5' S	123° 2' E
— New Hebrides	18° 46' S	169° 18' E	Flores Strait, S. Ent., Indian Archip.	8° 40' S	123° 3' E
Erzerum, Turkey in Asia	39° 57' N	48° 36' E	Florida Cape, Florida	25° 41' N	80° 5' W
Escorial, Spain	40° 36' N	4° 8' W	Flour (St.), France	45° 25' N	3° 6' E
Espada Cape, St. Domingo	18° 20' N	68° 34' W	Flushing, Netherlands	51° 27' N	3° 35' E
Epichel Cape, Portugal	38° 25' N	9° 14' W	Foggy Isle, N.W. Coast of America	56° 12' N	157° 19' W
Espiritu Santo, Brazil	20° 15' S	39° 28' W	Fogo Isle, Cape Verd Isles	14° 56' N	24° 20' W
Esquimaux Isles, Labrador	50° 18' N	63° 15' W	Fogo Isle, E. Coast of Africa	17° 12' S	38° 52' E
Estaim Bay, Sachalin	49° 0' N	142° 32' E	Foktschany, Turkey in Europe	45° 35' N	27° 3' E
Eustatia (St.) Isle, the Road, Carib. I.	17° 29' N	63° 5' W	Folkstone Church, England	51° 5' N	1° 11' E
Evangelists Isles, Patagonia	52° 34' S	75° 5' W	Fontarabia, Spain	43° 22' N	1° 47' W
Evau, France	46° 11' N	2° 11' E	Foreland (N.) Lighthouse, England	51° 22' N	1° 27' E
Evouts Isles, Tierra del Fuego	55° 32' S	66° 47' W	Foreland (S.) Lighthouse, England	51° 8' N	1° 22' E
Evreux, France	48° 55' N	1° 9' E	Formby Pt. N.W. Landmark, England	53° 33' N	3° 5' W
Exeter Cathedral, England	50° 43' N	3° 31' W	Formigas or Ants, Azores	37° 17' N	24° 53' W
Exuma Island N.W. Point, Lucayas	23° 33' N	75° 51' W	Formigues, Mediterranean	42° 35' N	10° 20' E
Eye Isle, Indian Archipelago	0° 24' N	129° 53' E	Formosa Cape, W. Coast of Africa	4° 25' N	5° 59' E
Ezija, Spain	37° 32' N	5° 5' W	Formosa Isle, N.E. Point, Chinese Sea	25° 11' N	121° 56' E
			— N.W. Point, Chinese Sea	25° 11' N	121° 6' E
			— S.E. Point, Chinese Sea	21° 54' N	121° 5' E
Færder I. (Gt.) Lighthouse, Norway	59° 3' N	10° 36' E	Formosa Mount, India	1° 49' N	102° 56' E
Fago Island, Newfoundland	50° 0' N	53° 54' W	Formosa R. Ent., W. Coast of Africa	5° 33' N	4° 35' E
Fairhill, Orkneys	59° 28' N	1° 55' W	Fortaventura Isle, W. Point, Canaries	28° 4' N	14° 31' W
Fairlight Church, England	50° 53' N	0° 38' E	Foul Point, Madagascar	17° 40' S	49° 53' E
Fairweather Cape, N.W. C. of Amer.	58° 51' N	138° 6' W	Foulness, England	52° 56' N	1° 20' E
Fair Foreland, Spitzbergen	78° 53' N	8° 45' E	Foulweather Cape, N.W. C. of Amer.	44° 49' N	123° 56' W
Fair Island, Orkney Islands	59° 29' N	1° 45' W	Fowler Pt., E. Extrem., New Holland	32° 1' S	132° 27' E
Falkenberg, Sweden	56° 54' N	12° 30' E	Foze Rock, Ireland	52° 1' N	10° 42' W
Falkland Isles, Port Egmont, Atl. O.	51° 24' S	59° 56' W	Français Cape (Old), St. Domingo	19° 40' N	70° 1' W
False Cape, E. Coast of Africa	34° 25' S	18° 52' E	Français Cape, the Town, St. Domingo	19° 46' N	72° 18' W
Falsterbo, Sweden	55° 23' N	12° 50' E	Francis (St.) Cape, Newfoundland	47° 57' N	52° 30' W
Fano, Italy	43° 51' N	13° 0' E	Francisco (St.) Port, New Albion	37° 48' N	122° 8' W
Fano Isle, W. Point, Mediterranean	39° 50' N	19° 20' E	Francisco Solano (St.) Port, Terra F.	6° 50' N	77° 47' W
Farewell Cape, Greenland	59° 42' N	45° 16' W	Frankfort on the Maine, Germany	50° 7' N	8° 36' E
Farewell Cape, New Zealand	40° 37' S	172° 50' W	Frankfort on the Oder, Germany	52° 22' N	14° 33' E
Farillon Isle, Ladrones	16° 1' N	146° 28' E	Frauenburg, Prussia	54° 22' N	19° 40' E
Faro, St. Antoni de Alto Ch, Portugal	36° 59' N	7° 51' W	Fredericksham, Gulf of Finland	60° 30' N	27° 25' E
Fartash Cape, Arabia	15° 34' N	51° 56' E	Frederickstadt, Norway	59° 12' N	11° 1' E
Fatsio Island, Japan Isles	33° 13' N	140° 12' E	Freels Cape, Newfoundland	49° 34' N	53° 0' W
Fayal Isle, Horta, Azores	38° 32' N	28° 43' W	Frehel Cape, France	48° 41' N	2° 19' W
Fecamp, France	49° 45' N	0° 23' E	Freisingen, Germany	48° 24' N	11° 45' E
Feldkirch, Germany	47° 14' N	9° 35' E	Freistadt, Germany	48° 29' N	14° 22' E
Felicuri Island, Mediterranean	38° 34' N	14° 29' E	Frejus, France	43° 26' N	6° 44' E
Felix Cape, Sumatra	3° 47' N	95° 58' E	Friendship Shoal, Indian Archipelago	5° 46' N	112° 46' E
Fells, Tower of the Castle, Spain	41° 16' N	1° 58' E	Frio Cape, Brazil	23° 0' S	42° 7' W
Feltri, Italy	46° 1' N	11° 55' E	— Brazil	22° 54' S	41° 36' W
Ferdar Light, Norway	59° 3' N	10° 36' E	Frio Cape, W. Coast of Africa	18° 37' S	12° 25' E
Fermo, Italy	43° 10' N	13° 42' E	Fromenterra W. Point, Mediterranean	38° 37' N	1° 24' E
Fernando-Poncha I. the Pyram, Atl. O.	3° 55' S	32° 35' W	Frontignan, France	43° 27' N	3° 45' E
Fernando-Po Isle, Atlantic Ocean	3° 28' N	8° 40' E	Froward Cape, Patagonia	53° 53' S	71° 11' W
Ferrara, Italy	44° 50' N	11° 36' E	Fuentes Fort, Italy	46° 8' N	9° 25' E
Ferro Isle, N. End, Canary Isles	27° 50' N	17° 58' W	Fuerte Isle, Centre, Terra Firma	9° 23' N	76° 14' W
Ferrol, Spain	43° 29' N	8° 15' W	Fulda, Germany	50° 34' N	9° 44' E
Fez, Morocco	34° 6' N	5° 1' W	Funon Odensee, Baltic Sea	55° 24' N	10° 22' E
Figueras, Spain	42° 16' N	2° 58' E	Furneaux I. Southern, C. of New Hol.	40° 34' S	148° 10' E
Finisterre Cape, Spain	42° 54' N	9° 16' W	Furneaux Isle, Pacific Ocean	17° 11' S	143° 7' W
Fiorenzo (St.) Corsica	42° 41' N	9° 18' E	Furnes, Netherlands	51° 4' N	2° 40' E
Fish Bay, N. Pt. Tig. Penin, W.C. of Af.	16° 31' S	11° 54' E			
Fiume, Illyria	45° 20' N	14° 26' E	Gabey Isle, Indian Archipelago	0° 6' S	126° 24' E
Fladstrand, Denmark	57° 27' N	10° 33' E	Gael Hawkes Bay, Greenland	75° 0' N	6° 51' W

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Galega Isle, Indian Ocean	10° 25' S	56° 38' E	Gomona Isle, Indian Archipelago.....	1° 56' S	127° 38' E
Galera Point, New Granada.....	0° 48' N	79° 51' W	Gonave Isle, N.E. Point, St. Domingo	18° 49' N	73° 1' W
Galina Point, Jamaica.....	18° 29' N	76° 54' W	Good-Hope Cape, New Guinea.....	0° 20' S	132° 31' E
Galita Isle, Centre, Mediterranean...	37° 32' N	8° 55' E	Good-Hope Cape, S. Coast of Africa...	34° 29' S	18° 23' E
Gall (St.) Observatory, Switzerland...	47° 26' N	9° 22' E	—— the Town, S.C. of Af.	33° 56' S	18° 23' E
Galle Point, Flagstaff, Ceylon.....	6° 1' N	80° 20' E	Goonong Apee Isle, Peak, Ind. Arch....	8° 11' S	119° 5' E
Galleta Island, Coast of Egypt.....	31° 27' N	27° 20' E	Goram Isle, Indian Archipelago.....	4° 0' S	131° 34' E
Gallipoli, Turkey in Europe.....	40° 26' N	26° 37' E	Gordewar Point, India.....	16° 48' N	82° 21' E
Gallo Cape, Sicily.....	38° 14' N	13° 19' E	Gore Isle, Sea of Kamtschatka.....	60° 17' N	172° 31' W
Galong Bay, Cochin China.....	18° 11' N	109° 20' E	Goree I., Governor's H., W. C. of Af.	14° 40' N	17° 26' W
Gamaley Cape, Japan.....	40° 38' N	139° 48' E	Goretti Isle, Paraguay.....	34° 56' S	54° 51' W
Gambier Isle, Pacific Ocean.....	23° 12' S	134° 59' W	Gorgona Isle, Mediterranean.....	43° 26' N	9° 53' E
Ganjam Flagstaff, India.....	19° 22' N	85° 10' E	Gorgona Isle, Pacific Ocean.....	2° 53' N	78° 6' W
Gap, France.....	44° 34' N	6° 4' E	Gortz, Germany.....	45° 57' N	13° 29' E
Gardafui Cape, E. Coast of Africa.....	11° 50' N	51° 32' E	Gotha, Observ. of Seeberg, Germany...	50° 56' N	10° 44' E
Gaspar Isle, Indian Archipelago.....	2° 25' S	107° 6' E	Gottenburg, Sweden.....	57° 42' N	11° 58' E
Gaspee Bay, Canada.....	48° 47' N	64° 27' W	Gottingen, Germany.....	51° 32' N	9° 56' E
Gasses Isle, S. Point, Indian Archip..	1° 41' S	128° 20' E	Gotland, N.E. End, Baltic Sea.....	57° 51' N	19° 7' E
Gata Cape, Cyprus.....	34° 31' N	33° 3' E	Gotto Isles, S.W. Extremity, Japan...	32° 35' N	128° 44' E
Gata Cape, Spain.....	36° 44' N	2° 13' W	Gouda, Netherlands.....	52° 0' N	4° 43' E
Gebel-Tor Isle, Red Sea.....	15° 32' N	42° 0' E	Gough's Isle, Atlantic Ocean.....	40° 18' S	9° 42' W
Gebel-Zebayr Isle, Red Sea.....	15° 3' N	42° 18' E	Goula-Batou Rock, Indian Archip....	9° 15' S	123° 51' E
Gebel-Zeghir Isle, Red Sea.....	14° 2' N	42° 52' E	Gower Cape, China.....	36° 57' N	122° 19' E
Geby Isle, N.W. End, Indian Archip. 0	48° 19' N	129° 19' E	Goza S. Point, Mediterranean.....	34° 50' N	24° 20' E
Geer Cape, N.W. Coast of Africa...	30° 38' N	9° 52' W	Gracias-a-Dios Cape, Mexico.....	14° 56' N	82° 45' W
Gefle, Sweden.....	60° 40' N	17° 8' E	Graciosa Isle, Santa Cruz, Azores...	39° 5' S	28° 0' W
Gelhausen, Germany.....	50° 13' N	9° 14' E	Graciosa-Dios Point, Patagonia.....	51° 43' S	69° 7' W
Genest (St.) Tower, France.....	43° 22' N	4° 39' E	Gradisca, Italy.....	45° 53' N	13° 25' E
Geneva, Switzerland.....	46° 12' N	6° 9' E	Grado, Italy.....	45° 40' N	13° 21' E
Genoa, Italy.....	44° 25' N	8° 58' E	Grafton Cape, New Holland.....	16° 53' S	146° 10' E
George (St.) Cape, Newfoundland.....	48° 30' N	59° 21' W	Grampus Isles, Pacific Ocean.....	25° 10' N	146° 0' E
George (St.) Cape, New Ireland...	4° 51' S	152° 49' E	Grand (le) Cape, New Holland.....	34° 1' S	122° 4' E
George (St.) I., Cape Rena, Archip....	38° 43' N	24° 28' E	Grand-Combe des Bois, France.....	47° 9' N	6° 47' E
George (St.) Isle, S.E. Point, Azores...	38° 31' N	27° 51' W	Grange Point, St. Domingo.....	19° 55' N	71° 49' W
Georgetown, United States.....	38° 55' N	77° 10' W	Granville, France.....	48° 50' N	1° 36' W
Georgia (S.) Isle, C. Disapp., Atl. O. ..	54° 58' S	36° 15' W	Graoharum Lighthouse, Russia in Eu.	60° 6' N	25° 2' E
—— N. Cape, Atl. O.	54° 5' S	38° 15' W	Grasse, France.....	43° 39' N	6° 55' E
Gera, Germany.....	50° 53' N	12° 4' E	Graz, Germany.....	47° 4' N	15° 27' E
Geriah Point, India.....	16° 31' N	73° 25' E	Gravelines, France.....	50° 59' N	2° 8' E
Gerona Cathedral, Spain.....	41° 59' N	2° 50' E	Gravesande, Netherlands.....	52° 0' N	4° 10' E
Gertrudenburg, Netherlands.....	51° 42' N	4° 52' E	Gravois Point, St. Domingo.....	18° 1' N	74° 2' W
Ghent, Netherlands.....	51° 3' N	3° 44' E	Grays Port, N.W. Coast of America...	47° 0' N	123° 53' W
Gibraltar, Europa Point, Spain.....	36° 7' N	5° 22' W	Greenwich Observatory, England.....	51° 29' N	0° 0' W
Gidros, Turkey in Asia.....	41° 53' N	32° 54' E	Greiswalde, Germany.....	54° 5' N	13° 33' E
Gigat Point, India.....	22° 20' N	69° 16' E	Grenaae, Denmark.....	56° 25' N	10° 54' E
Gijon, Hermitage of St. Catal, Spain...	43° 35' N	5° 36' W	Grenada I., Fort Royal, Caribbee Isles	12° 3' N	61° 48' W
Gillolo Isle, Ossa Village, Indian Arch.	0° 45' N	128° 22' E	—— N.E. Point, Caribbee Isles	12° 13' N	61° 31' W
Giraglia Tower, Corsica.....	43° 2' N	9° 24' E	Grenoble, France.....	45° 12' N	5° 44' E
Girge, Egypt.....	26° 22' N	31° 55' E	Grenville's Inlet, E. Florida.....	26° 47' N	80° 1' W
Girgenti Lighthouse, Sicily.....	37° 16' N	13° 31' E	Grim Cape, Van Dieman's Land.....	40° 41' S	144° 46' E
Glandeves, France.....	43° 57' N	6° 48' E	Grodno, Russia in Europe.....	53° 40' N	23° 50' E
Glasgow, Scotland.....	55° 52' N	4° 16' W	Gronskar, Sweden.....	59° 16' N	19° 2' E
Glastonbury Tor, England.....	51° 9' N	2° 41' W	Groote Isle, Central Hill, New Hol...	13° 57' S	136° 41' E
Glenan Isles, W. Coast of France.....	47° 44' N	4° 0' W	Grouais Isle, France.....	47° 38' N	3° 26' W
Gloucester Cape, Terra del Fuego.....	54° 7' S	73° 35' W	Guacera, Terra Firma.....	10° 11' N	68° 5' W
Gloucester Island, Pacific Ocean.....	19° 11' S	140° 20' W	Guadalcanal I. Esperance C., Solom. I.	9° 32' S	159° 41' E
Gloucester Cape, N. Hill, New Hol....	19° 59' S	148° 26' E	Guadaloupe Isle, Pacific Ocean.....	28° 53' N	118° 16' W
Gloucester Cathedral, England.....	51° 52' N	2° 14' W	Guadaloupe Isle, Basseterre, Carib. I.	15° 59' N	61° 45' W
Gloucester House, New Wales.....	51° 24' S	87° 3' W	Guaduas, Terra Firma.....	5° 4' N	74° 48' W
Gloucester Mount, New Britain.....	5° 31' S	148° 23' E	Guaira, Terra Firma.....	10° 36' N	67° 7' W
Glover's Reef, N. Point, Bay of Hond.	16° 44' N	87° 30' W	Guaisabon Peak, Cuba.....	22° 48' N	83° 27' W
Gluckow, Russia in Europe.....	51° 40' N	34° 20' E	Guam I. Umatac Bay Castle, Pac. O.	13° 21' N	144° 20' E
Gluckstadt, Germany.....	53° 48' N	9° 27' E	Guanaxuato, Mexico.....	21° 0' N	100° 55' W
Goa, Algoada Point, India.....	15° 29' N	73° 53' E	Guascama Point, Terra Firma.....	2° 29' N	78° 23' W
Goat Isle, Philippine Isles.....	13° 52' N	120° 6' E	Guastalla, Italy.....	44° 55' N	10° 40' E
Godthaab, Greenland.....	64° 10' N	51° 48' W	Guayaquil, Peru.....	2° 11' S	79° 41' W
Goos, Netherlands.....	51° 30' N	3° 53' E	—— Peru.....	2° 11' S	79° 56' W
Gowatscheff Cape, Sachalin.....	53° 30' N	141° 55' E	Guldres, Germany.....	51° 31' N	6° 19' E
Gomera Isle, the Port, Canaries.....	28° 6' N	17° 8' W	Guernsey Island, St. Pierre, British C.	49° 26' N	2° 33' W

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Guinchos Quay, Lucayos	22 44 N	78 5 W	Hogstraeten, Netherlands	51 24 N	4 46 E
Gunterburg, Germany	49 10 N	13 27 E	Hola, Iceland	65 44 N	19 44 W
Guntzburg, Germany	48 27 N	10 16 E	Holy Isle, Castle Flagstaff, England	55 40 N	1 47 W
Gurief, Russia in Asia	47 7 N	51 59 E	Holyhead Mountain, Sig. Staff, Eng.	53 19 N	4 39 W
Hackluyts Head, Spitzbergen	79 46 N	9 49 E	Honda, Terra Firma	5 12 N	74 53 W
Hadersleben, Denmark	55 15 N	9 31 E	Hondschoote, Netherlands	50 59 N	2 35 E
Hafringe Lighthouse, Sweden	58 36 N	17 18 E	Honfleur, France	49 25 N	0 14 W
Hague, Netherlands	52 5 N	4 19 E	Hood Point, New Holland	34 23 S	119 33 E
Hailui Island, W. Point, China	21 34 N	111 54 E	Hood's (Lord) Island, Pacific Ocean	21 42 S	135 32 W
Halberstadt, Germany	51 54 N	11 4 E	Hoeglede, Netherlands	50 59 N	3 5 E
Halifax, Nova Scotia	44 44 N	63 36 W	Hope Island, Spitzbergen	76 30 N	20 28 E
Hallands Vadero, Sweden	56 27 N	12 32 E	Horn Cape, Tierra del Fuego	55 58 S	67 21 W
Halle, Germany	51 29 N	11 58 E	Horsham Church, England	51 4 N	0 20 W
Halmstadt, Sweden	56 40 N	12 52 E	Howe's (Lord) Island, Pacific Ocean	31 30 S	159 0 E
Hamburg, Germany	53 33 N	9 59 E	Howe Cape, New Holland	37 30 S	150 7 E
Hamelin, Germany	52 5 N	9 20 E	Huahine Isle, Owharree Bay, Pacif. O.	16 43 S	151 9 W
Hammerfest, Norway	70 38 N	23 43 E	Hudson's House, New Wales	53 1 N	106 27 W
Hammond's Rock, Atlantic Ocean	36 45 N	23 10 W	Hudwickswall, Sweden	61 44 N	17 8 E
Hangcliff, Shetland Isles	60 9 N	0 56 W	Huehuetoca, Mexico	19 49 N	99 12 W
Haugo-Udd Cape, Russia in Europe	59 46 N	22 58 E	Huiddingsoe Isle, Lighthouse, Norway	59 4 N	5 25 E
Hano Isle, Sweden	56 1 N	14 49 E	Hui-ling-san Harb., S.E. Ent., China	21 34 N	111 47 E
Hanover, Germany	52 22 N	9 43 E	Hulst, Netherlands	51 17 N	4 3 E
Hanover (New) I., S.W. Pt., Pacif. O.	2 31 S	149 50 E	Hunstanton Lighthouse, England	52 59 N	0 31 E
Hapae, N. Point, Friendly Isles	19 48 S	174 5 W	Hunter Port, New Holland	32 56 S	151 43 E
Haradskr Beacon, Sweden	58 8 N	16 59 E	Huntingdon Steeple, England	52 20 N	0 11 W
Harbour Island, N. Point, Lucayos	25 31 N	76 47 W	Hurd Cape, Greenland	77 42 N	78 47 W
Harlem, Netherlands	52 23 N	4 38 E	Hurst Lights, England	50 42 N	1 33 W
Harlem's Bay, Mendoza Isle, China	22 31 N	114 51 E	Husum, Denmark	54 29 N	9 5 E
Harlingen, Netherlands	53 11 N	5 25 E	Hydrabad, India	17 12 N	78 51 E
Hartland Point, England	51 1 N	4 30 W	Hyeres, France	43 7 N	6 8 E
Hartlepool Steeple, England	54 42 N	1 11 W	Hypsili Isle, Archipelago	38 1 N	26 52 E
Harvey's Island, Pacific Ocean	19 17 S	158 56 W	Ibague, Terra Firma	4 28 N	75 20 W
Haselo Island, Cattagat	56 12 N	11 40 E	Ibarra, Peru	0 21 N	78 19 W
Hastings Isle, Indian Archipelago	6 59 S	116 26 E	Icy Cape, N.W. Coast of America	70 29 N	161 42 W
Hatteras Cape, United States	35 14 N	75 34 W	Iena, Germany	50 57 N	11 37 E
Havannah, the Morro, Cuba	23 9 N	82 23 W	Iglau, Germany	49 23 N	15 36 E
Havre de Grace, France	49 29 N	0 7 E	Ilchester Steeple, England	51 0 N	2 40 W
Hawlis Island, Carolines	7 30 N	146 28 E	Ildefonso (St.) Isles, Terra del Fuego	55 55 S	69 18 W
Heckla Cape, Iceland	63 22 N	19 54 W	Imst, Germany	47 14 N	10 44 E
Hedie Isle, France	47 21 N	2 51 W	Inague Isle (Great) N.E. End, Lucayos	21 19 N	73 2 W
Hegadis Isle, Indian Archipelago	6 13 S	122 40 E	— S.W. End, Lucayos 20 54 N	73 38 W	
Helbre Lighthouse, England	53 24 N	3 10 W	Inague Isle (Little), E. End, Lucayos 21 27 N	72 56 W	
Helena (St.) I., James Town, Atlan. O.	15 55 S	5 43 W	Ines (St.) Cape, Tierra del Fuego	54 8 S	66 57 W
Helena (St.) Point, Patagonia	44 30 S	65 29 W	Ingleborough Hill, England	54 10 N	2 23 W
Helena (St.) Point, Peru	2 10 S	80 47 W	Ingolstadt, Germany	48 16 N	11 26 E
Helen's Shoal, Pacific Ocean	2 51 N	131 34 E	Ingornachoix, Newfoundland	50 37 N	57 15 W
Heligoland (St.) I., German Ocean	54 12 N	7 53 E	Inhamban Bay, Inhamban, E. C. of Af. 23 51 S	35 42 E	
Helsingborg, Sweden	56 3 N	12 43 E	Iuichi, Turkey in Asia	42 0 N	33 56 E
Helsingfors, Russia in Europe	60 10 N	25 0 E	Inselberg Mountain, Germany	50 52 N	10 28 E
Helvellin Mountain, England	54 32 N	3 0 W	Inspruck, Germany	47 16 N	11 24 E
Helvoet Sluys, Netherlands	51 49 N	3 28 E	Inverness, Scotland	57 31 N	4 12 W
Henley House, New Wales	51 14 N	85 7 W	Ipsera Isle, S. Point, Archipelago	38 30 N	25 36 E
Henry and Kenery Isles, Indian Ocean	18 42 N	72 53 E	Irkutsk, Russia in Asia	52 17 N	104 11 E
Henry Cape, Lighth., United States	36 57 N	75 47 W	Isaac Rock (Great), Lucayos	26 2 N	79 9 W
Henrietta Cape, Hudson's Bay	55 10 N	82 30 W	Isaac Rock (Little), Lucayos	25 57 N	78 51 E
Heraclea, Turkey in Europe	41 1 N	27 55 E	Isabella Point, St. Domingo	19 59 N	71 17 W
Herenthals, Netherlands	51 11 N	4 50 E	Islamabad, India	22 20 N	91 45 E
Hermogenes (St.) I., N.W. C. of Amer. 58 15 N	152 13 W	152 13 W	Isle of Pines, New Caledonia	22 38 S	167 38 E
Hernosaud Isle, Sweden	62 38 N	17 53 E	Ismail, Turkey in Europe	45 21 N	28 50 E
Hesseloe Isle, Denmark	56 12 N	11 40 E	Isola-Bella, Italy	45 53 N	8 32 E
Hinchinbrook Cape, N.W. C. of Amer. 60 12 N	146 39 W	146 39 W	Ispahan, Persia	32 25 N	51 50 E
Hinlopen Cape, Lighth., United States 38 47 N	75 6 W	75 6 W	Ives (St.), England	50 13 N	5 28 W
Hioring, Denmark	57 28 N	10 0 E	Ivica Isle, the Castle, Mediterranean	38 53 N	1 29 E
Hoiagnan, China	33 35 S	118 50 E	Jackson (Port) Castle Pt., New Hol.	33 51 S	151 16 E
Hoberg Cape, Sweden	56 56 N	18 11 E	Jaffa, Syria	32 5 N	34 46 E
Hogland Island Light, Gulf of Finland 60 3 N	27 7 E	27 7 E	Jaffa Cape, New Holland	36 57 S	139 41 E
Hogsties Islets, Easternm. I., Lucayos	21 39 N	73 56 W	Jago (St.) I., Porto Praya, C. Verd. I. 14 53 N	23 32 W	

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Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Jahde, Germany	53 21N	8 13E	King's Isle, N. Point, Bass's Straits. .	39 37S	143 54E
Jakutsk, Russia in Asia	62 2N	129 42E	King George's Sound, New Holland. .	35 6S	118 1E
James (St.) Cape, Cochin China. .	10 18N	107 10E	Kingston, Jamaica	18 0N	76 42W
Jaroslavl, Russia in Europe. .	57 37N	40 10E	Kilda (St.), Lewis Islands	57 49N	8 26W
Jarra Isle, Straits of Malacca	4 0N	100 14E	Kinnaird's Head, Scotland	57 42N	2 1W
Jask Cape, Persia	25 38N	58 10E	Kinsale, Ireland	51 41N	8 28W
Jassy, Moldavia	47 8N	27 30E	Kiøge, Denmark	55 27N	12 12E
Java Head, Java	6 48S	105 11E	Kiow, Russia in Europe	50 27N	30 28E
Jean-Leton Reef Cape, Verd Isles. .	15 48N	22 56W	Kiringskoi-Ostrog, Russia in Asia. .	57 47N	108 3E
Jean de Luz (St.), France	43 23N	1 41W	Kittery Point, United States	43 4N	70 44W
Jedo (Nippon) Island, Japan Isles. .	36 29N	140 0E	Kittis, Lapland	66 48N	24 3E
Jenikola, Crimea	45 23N	36 27E	Klagenfurth, Germany	46 37N	14 20E
Jeniseisk, Russia in Asia	58 27N	91 59E	Klin, Russia in Europe	56 20N	36 48E
Jeremie Point, St. Domingo. .	18 40N	74 13W	Koenigsburg, Prussia	54 42N	20 29E
Jersey Isle, St. Aubin, British Chan. .	49 13N	2 11W	Kokskar Light, Gulf of Finland. .	59 40N	25 3E
Jerusalem, Turkey in Asia	31 48N	35 20E	Kola, Russia in Europe	68 52N	33 1E
Jervis Bay, Cape George, New Hol. .	35 9S	150 56E	Koluga, Russia in Europe	54 30N	36 5E
Jervis Isle, Torres Strait	9 56S	142 9E	Kongelf, Sweden	57 52N	11 59E
Jesso Island, Cape Euroen, Japan Sea	42 2N	143 18E	Kongsbacka, Sweden	57 27N	12 7E
Jesus Island, Friendly Isles	6 46S	166 0W	Kongslinger, Norway	60 12N	11 58E
Jever, Germany	53 34N	7 53E	Koraka Cape, Turkey in Asia	38 6N	26 35E
Johanna Isle, Centre, Comoro Isles. .	12 16S	44 30E	Korn-Neuburg, Germany	48 21N	16 19E
Johannisberg, Prussia	53 38N	21 49E	Korsar Light, Denmark	55 20N	11 8E
John's (St.) Cape, Candia	35 16N	23 30E	Koseir, Egypt	26 8N	34 15E
John's (St.) Cape, W. Coast of Africa	1 15N	9 15E	Koslof, Russia in Europe	45 12N	33 23E
John's (St.) Fort, Newfoundland. .	47 34N	52 40W	Kostroma, Russia in Europe	57 46N	41 13E
John's (St.) Isle, Red Sea	23 35N	36 10E	Kovima (Lower), Russia in Asia. .	68 18N	163 18E
John's (St.) Isle, E. Cape, Carrib. I.	18 20N	64 47W	Kovima (Upper), Russia in Asia. .	65 28N	153 35E
John-de-Nova Isles, Indian Ocean ..	10 15S	51 10E	Krageroe, Norway	58 51N	9 30E
Johnston's Isles, Pacific Ocean ..	16 53N	169 31W	Krannichfeld, Germany. .	50 52N	11 12E
Jonas Peak, Sea of Okto-k	56 25N	143 16E	Krasnoyan, Russia in Asia	56 1N	92 21E
Jones's Cape, Hudson's Bay	54 50N	78 54W	Krementzouk, Russia in Europe. .	49 3N	33 29E
Joseph (St.), California	23 3N	109 41W	Krems, Germany	48 21N	15 36E
Josna Rock, Atlantic Ocean	31 37N	23 45W	Krio Cape, Turkey in Asia	36 41N	27 21E
Juan (St.) Cape, Porto Rico	18 23N	65 32W	Kronotskoi Noss, Kamtschatka ..	54 43N	162 13E
— Porto Rico	18 29N	66 43W	Kuisin South End, Japan Isles. .	31 48N	132 35E
Juan (St.) Cape, Staten Land	54 47S	63 42W	Kullen Lighthouse, Sweden	56 18N	12 36E
Juan-Fernandez Isle, Pacific Ocean. .	33 40S	78 58W	Kurachee Port, India	24 52N	67 17E
Juddah, Arabia	21 29N	39 15E	Kurile Isles, North End, Pacific Ocean	47 10S	63 6E
Ju'enburg, Germany	47 43N	14 43E	Kursk, Russia in Europe	51 43N	36 28E
Julian (St.) Port, C. Curiosa, Patagonia	49 5S	67 44W			
			Labiau, Prussia	54 51N	21 7E
Kaisersheim, Germany	48 46N	10 48E	Laccadive Isles, N.W. Pt., Indian O.	13 30N	70 45E
Kakava Isle, N.E. Pt., Turkey in Asia	36 11N	29 57E	Ladrone Isle (Great), Chinese Sea. .	21 57N	113 43E
Kalatoa Isle, Indian Archipelago. .	7 20S	121 40E	Lagoon Isle, Pacific Ocean	21 38S	140 37W
Kallandborg, Denmark	55 41N	11 7E	Lagos, Portugal	37 6N	8 38W
Ka'cyeri Rocks, Pk. of Gt. Rock, Arch. .	38 10N	25 17E	Lagos, Turkey in Europe	40 59N	25 4E
Kalpeny Isle, Laccadives	10 5N	74 1E	Laholm, Sweden	56 33N	13 1E
Kamnieck, Russia in Europe	48 41N	27 1E	Lambay I., Knockbarn Hill, Ireland	53 30N	6 0W
Kamtschatkoi Noss, Kamtschatka ..	56 1N	163 22E	Lambaess, Shetland Isles	60 46N	0 58W
Kamyschin, Russia in Asia	50 5N	45 24E	Lambhuus, Iceland	64 6N	21 55W
Kaneoonang Point, Borneo	1 5N	119 10E	Lampedosa Isle, Mediterranean. .	35 31N	12 30E
Karadash, Turkey in Asia	36 33N	35 21E	Lampsaco, Turkey in Asia	40 21N	26 37E
Karak Isle, Flagstaff, Gulf of Persia. .	29 16N	50 27E	Lancaster, United States	40 3N	76 19W
Kasan, Russia in Europe	55 48N	49 21E	Lancaster Steeple, England	54 3N	2 48W
Kaskon, Russia in Europe	62 22N	21 11E	Lancerota Isle, E. Point, Canaries. .	29 14N	13 26W
Katif Bay, N. Point, Arabia	26 36N	50 12E	Land's End, England	50 4N	5 42W
Kaufbeuren, Germany	47 53N	10 37E	Landsberg, Germany	48 3N	10 54E
Kent's Group, New Holland	39 27N	147 15E	Landscrem, Sweden	55 52N	12 51E
Keppel Bay, New South Wales. .	23 29S	150 58E	Landsorbe Lighthouse, Sweden ..	58 44N	17 52E
Keppel's Island, Friendly Isles	15 53S	174 12W	Langle Bay, Sachalin	48 59N	142 33E
Kerguelen's Land, Christ Hrb., Ind. O.	48 41S	69 2E	Langle Peak, Jesso	45 11N	141 13E
— C. George, Ind. O.	49 54S	70 12E	Langres, France	47 52N	5 20E
Kertch, Crimea	45 21N	36 21E	Languard Port, Cupola, England. .	51 56N	1 19E
Kiam-chieu, China	35 37N	111 29E	Laon, France	49 34N	3 37E
Kidwelly Spire, Wales	51 44N	4 17W	Larneca Castle, Cyprus	34 54N	33 41E
Kiel, Germany	54 20N	10 8E	Lati Island, Friendly Isles	18 54S	174 48W
Kilduin Isle, N. End, Rus. in Europe	69 10N	33 50E	Latikia, Syria	35 30N	35 48E
			Laubach, Germany	46 2N	14 47E

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Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Launceston Steeple, England	50° 36' N	4° 21' W	London, St. Paul's, England	51° 31' N	0° 6' W
Lausanne, Switzerland	46° 31' N	6° 45' E	London Shoal (E.) Centre, Ch. Sea	51° 8' N	112° 25' E
Lavaur, France	43° 41' N	1° 49' E	London Shoal (W.) Centre, Ch. Sea	51° 8' N	112° 0' E
Lawrence (St.) I., Sea of Kamtschatka	63° 47' N	171° 45' E	Londonderry, Ireland	54° 59' N	7° 15' W
Lawrence (St.) Isles, Indian Ocean	9° 35' S	52° 15' E	Long Island, S.E. Point, Lucayos	22° 49' N	74° 45' W
Leasowes Lighthouse, England	53° 25' N	3° 7' W	Long Island, E. Hamp., United States	41° 0' N	72° 16' W
Lectoure, France	43° 56' N	0° 37' E	— E. Pt. Lighth., United S.	41° 4' N	71° 52' W
Leer, Germany	53° 14' N	7° 25' E	Lookout Point, New Holland	27° 27' S	153° 31' E
Leeuwin Cape, New Holland	34° 19' S	115° 6' E	Lookout Point, United States	38° 1' N	76° 12' W
— New Holland	34° 26' S	115° 35' E	Loop Head, Ireland	52° 34' N	9° 52' W
Leghorn, Italy	43° 33' N	10° 17' E	Loos Isle, W. Coast of Africa	9° 27' N	13° 20' W
Legnago, Italy	45° 11' N	11° 19' E	Lopatka Cape, Kamtschatka	51° 0' N	156° 43' E
Leipsic, Germany	51° 20' N	12° 22' E	Lopez Cape, W. Coast of Africa	0° 59' S	9° 17' E
Leiva, Terra Firma	5° 30' N	73° 54' W	Lorenzo (St.) Cape, Peru	1° 4' S	80° 43' W
Lekeyo, North End, Chinese Sea	27° 52' N	128° 45' E	Loretto, Italy	43° 27' N	13° 35' E
Le Mans, France	48° 0' N	0° 12' E	L'Orient, France	47° 45' N	3° 21' W
Lemna I. (Gt.) Centre, Chinese Sea	22° 28' N	114° 16' E	Loughborough Steeple, England	52° 47' N	1° 12' W
Le Memes Reef, Indian Ocean	1° 20' N	94° 20' E	Loughton Spire, England	53° 23' N	1° 13' W
Lemnos Island, Archipelago	40° 0' N	25° 15' E	Louisburg, Cape Breton Isle	45° 54' N	59° 55' W
Leon, Mexico	12° 21' N	86° 45' W	Louisiade Cape, New Guinea	11° 21' S	128° 21' E
Leon, Isle, Spain	36° 28' N	6° 12' W	Louvain, Netherlands	50° 53' N	4° 42' E
Leone, Isle, Pacific Ocean	14° 6' S	169° 16' W	Lowestoff, England	52° 29' N	1° 46' E
Leopanto, Turkey in Europe	38° 16' N	22° 1' E	Loyalty Isle, New Caledonia	20° 54' S	166° 30' E
Le Puy, France	45° 3' N	3° 54' E	Lubeck, Germany	53° 51' N	10° 41' E
Lescar, France	43° 20' N	0° 26' W	Lubeck Isle, Indian Archipelago	5° 45' S	112° 48' E
Lessor Island, East End, Cattegat	57° 19' N	11° 11' E	Lubni, Russia in Europe	50° 1' N	33° 4' E
Lettee I., W. Point, Ind. Archipelago	8° 16' S	127° 46' E	Lucas (St.) Cape, California	22° 52' N	109° 50' W
Levata Isle, S. Point, Archipelago	36° 59' N	26° 17' E	Lucia Island (St.) Careenage, Carib. I.	13° 57' N	61° 7' W
Leven's (St.) Pt., Flagstaff, England	50° 4' N	5° 41' W	Lucipara Isle, Indian Archipelago	3° 13' S	106° 12' E
Lew-chew I. (Gt.), Chinese Sea	26° 14' N	127° 38' E	Luçon, France	46° 27' N	1° 10' W
Lewis-Town, United States	38° 47' N	75° 16' W	Lugano, Italy	46° 0' N	8° 58' E
Leyden, Netherlands	52° 9' N	4° 29' E	Luiz-Maranhã (St.), Brazil	2° 30' S	44° 5' W
Libau, Courland	56° 32' N	20° 55' E	Lunaire (St.) Bay, Newfoundland	51° 29' N	55° 30' W
Lichteau, Germany	51° 37' N	8° 54' E	Lunde, Norway	58° 27' N	6° 36' E
Liege, Germany	50° 39' N	5° 32' E	Lunden Tower, Sweden	55° 43' N	13° 13' E
Lilienthal, Germany	53° 8' N	8° 54' E	Lundy Isle, St. Ann's Chapel, England	51° 10' N	4° 38' W
Lima, Peru	12° 3' S	76° 57' W	Lutterworth Steeple, England	52° 27' N	1° 12' W
Limoges, France	45° 50' N	1° 15' E	Luxemburg, Netherlands	49° 38' N	6° 10' E
Limpjadia, Turkey in Europe	40° 37' N	23° 44' E	Lyme Cobo, England	50° 43' N	2° 55' W
Lincoln Isle, Chinese Sea	16° 41' N	112° 42' E	Lynn Old Tower, England	52° 47' N	0° 25' E
Lincoln Minster, England	53° 14' N	0° 32' W	Lyons, France	45° 46' N	4° 49' E
Lindnes Lighthouse, Norway	57° 58' N	7° 3' E			
Lingin Isle, S.E. Pt., Indian Archip.	0° 21' S	105° 4' E	Macao, China	22° 11' N	113° 31' E
Lintz, Germany	48° 19' N	14° 17' E	Macassar, Celebes	5° 9' S	119° 39' E
Lion's Bank, Atlantic Ocean	56° 40' N	17° 45' W	Macanley Island, Pacific Ocean	30° 8' S	179° 0' W
Lipari Isle, the Castle, Mediterranean	38° 29' N	14° 56' E	Macclesfield Bank, Chinese Sea	15° 51' N	114° 18' E
Lisbon Observatory, Portugal	38° 42' N	9° 8' W	Macerata, Italy	43° 19' N	13° 26' E
Lisburne Cape, N.W. C. of America	69° 55' N	165° 22' W	Machichaco Point, Spain	43° 28' N	2° 49' W
Lissa Island, S. Pt., Gulf of Venice	43° 13' N	16° 15' E	Macon, France	46° 18' N	4° 50' E
Lissamatula I., S.E. Pt., Indian Archip.	1° 46' S	126° 32' E	Macri Cape, Turkey in Europe	40° 30' N	25° 38' E
Litchfield Spire, England	52° 41' N	1° 49' W	Madeira Island, E. Pt., Ind. Arch.	6° 53' S	113° 58' E
Little Bank, N.W. Extrem., Lucayos	27° 35' N	79° 0' W	Madeira Isle, Funchal, Atlantic Ocean	32° 37' N	16° 58' W
Liverpool, St. Paul's, England	53° 53' N	25° 29' W	Madona Isle, W. Point, Archipelago	36° 31' N	26° 52' E
Lizard W. Lighthouse, England	49° 58' N	5° 11' W	Madras Flagstaff, India	13° 4' N	80° 22' E
Lizier (St.), France	43° 0' N	1° 8' E	Madrid (New), United States	36° 34' N	89° 27' W
Lizieux, France	49° 9' N	0° 14' E	Madrid, Grand Square, Spain	40° 25' N	3° 42' W
Loango Bay, W. Coast of Africa	4° 36' S	12° 20' E	Maestricht, Netherlands	50° 51' N	5° 41' E
Lobos Quay, Lucayos	22° 25' N	77° 36' W	Mafame Isle, E. Coast of Africa	16° 21' S	40° 25' E
Lobos-de-Tierra Isle, Peru	6° 25' S	80° 45' W	Magadaxa, E. Coast of Africa	2° 5' N	45° 49' E
Lodeve, France	43° 44' N	3° 19' E	Magdalen I., S. End, Gulf of St. Law.	47° 11' N	61° 43' W
Lodi, Italy	45° 19' N	9° 31' E	Magdeburg, Germany	52° 8' N	11° 39' E
Loheia, Arabia	15° 44' N	42° 44' E	Mahe Isles, St. Ann's Isle, Ind. Ocean	4° 35' S	55° 35' E
— Arabia	15° 42' N	42° 9' E	Mahon, Cape Mola, Minorca	39° 51' N	4° 18' E
Lombes, France	43° 28' N	0° 54' E	Mahouna Isle, Pacific Ocean	14° 21' S	170° 17' W
Lomblen I., High Peak, Indian Archip.	8° 12' S	123° 52' E	Maize Cape, Cuba	20° 17' N	74° 8' W
Lombeck I., the Peak, Indian Archip.	8° 21' S	116° 26' E	Majambo Bay, Entrance, Madagascar	15° 10' S	47° 6' E
Lomond Mountain, W. Top, Scotland	56° 15' N	3° 17' W	Maker Tower Flagstaff, England	50° 21' N	4° 10' W
London (New) Light, United States	41° 21' N	72° 9' W	Makry, the Theatre, Turkey in Asia	36° 36' N	29° 7' E
London, St. James's Ch., Picdly., Eng.	51° 31' N	0° 8' W	Malacca Fort, India	2° 12' N	102° 15' E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Malaga, Spain	36° 43' N	4° 25' W	May Cape, United States	38° 57' N	74° 53' W
Mala-Pasqua Cape, Porto Rico	18° 0' N	65° 42' W	May Isle, Lighthouse, Scotland	56° 11' N	2° 33' W
Maldives Isles, N.W. Pt., Indian Ocean	7° 6' N	73° 8' E	Mayen's (John) Island, Greenland	71° 10' N	9° 49' W
Maldives Isles, S.E. Pt., Indian Ocean	0° 36' S	73° 25' E	Mayo Isle, S. Point, Cape Verd Isles	15° 5' N	23° 8' W
Malespina Cape, Jesso	43° 42' N	141° 19' E	Mayotta Isle, the Peak, Comoro Isles	12° 54' S	45° 14' E
Malines, Netherlands	51° 2' N	4° 29' E	Maysi Cape, Cuba	20° 14' N	73° 59' W
Mallicollo I., Port Sandw., New Hebr.	16° 25' S	167° 32' E	— Cuba	20° 17' N	74° 8' W
— New Hebr.	16° 25' S	167° 53' E	Mazzarra Citadel, Sicily	37° 40' N	12° 33' E
Malmö, Sweden	55° 37' N	13° 1' E	Meaux, France	48° 58' N	2° 53' E
Malo (St.), France	48° 39' N	2° 1' W	Meiningen, Germany	50° 35' N	10° 24' E
Maouines I., Port Egmont, Falkland I.	51° 25' S	59° 59' W	Melille, Barbary	35° 18' N	2° 56' W
Malta Isle, Valetta Observ., Mediter.	35° 53' N	14° 31' E	Memel, Russia in Europe	55° 42' N	21° 8' E
Manapar Point, India	8° 22' N	78° 16' E	Mende, France	44° 31' S	3° 30' E
Mancap Isle, Indian Archipelago	3° 1' S	110° 7' E	Mendocin Cape, N.W. Coast of Amer.	40° 29' N	124° 29' W
Manchester, St. Mary's Spire, Eng.	53° 29' N	2° 14' W	Meroe Isle, Bay of Bengal	7° 29' N	93° 46' E
Mandal, Norway	58° 1' N	7° 28' E	Messina Lighthouse, Sicily	38° 11' N	15° 35' E
Mandarin's Cap Isle, Chinese Sea	21° 28' N	112° 21' E	Mesurado Cape, W. Coast of Africa	6° 15' N	10° 36' W
Mandry Port, Turkey in Europe	37° 44' N	23° 49' E	Mesurat Cape, Barbary	32° 25' N	15° 10' E
Mangalore, India	12° 50' N	75° 7' E	Meiz, France	49° 7' N	6° 10' E
Mangea Isle, Pacific Ocean	21° 57' S	158° 3' W	Mexico, Mexico	19° 26' N	99° 5' W
Mangles Point, Peru	1° 36' N	78° 50' W	Mexillones, Peru	23° 5' S	70° 25' W
Manheim Observatory, Germany	49° 29' N	8° 28' E	Miatea Isle, Pacific Ocean	17° 52' S	148° 6' W
Manilla, Luconia	14° 36' N	120° 58' E	Michael's (St.) Isle, E. Point, Azores	37° 48' N	25° 13' W
Mansfelt Isle, N. End, Hudson's Bay	62° 38' N	80° 33' W	— W. Point, Azores	37° 54' N	25° 57' W
Mantua, Italy	45° 5' N	10° 48' E	Michael's (St.) Mount, England	50° 7' N	5° 28' W
Manvers Port, Labrador	57° 1' N	61° 49' W	Michael's (St.) Mount, France	48° 38' N	1° 30' W
Maouna I., Massacre Cove, Fdly. I.	14° 21' S	170° 17' W	Middle Island, S.W. Pt., Chinese Sea	2° 55' S	107° 4' E
Marabia Reef, W. Point, Red Sea	19° 11' N	40° 5' E	Middleburg, Netherlands	51° 30' N	3° 37' E
Maracaybo, Terra Firma	10° 45' N	70° 50' W	Middleton Shoals, Pacific Ocean	29° 18' S	159° 28' E
Maragalang Isles, Indian Archipelago	3° 41' S	116° 54' E	Milan Observatory, Italy	45° 28' N	9° 12' E
Marble Island, Hudson's Bay	62° 33' N	91° 6' W	Milazzo Lighthouse, Sicily	38° 16' N	15° 13' E
Marburg, Germany	46° 35' N	15° 43' E	Milo Isle, the Port, Archipelago	36° 42' N	24° 14' E
Marc (St.) Cape, St. Domingo	19° 29' N	72° 55' W	Mimbres Isle, Centre, Lucayos	25° 16' N	79° 11' W
Marco (St.) Cape, Sicily	37° 22' N	13° 1' E	Mindanao, Philippine Isles	7° 10' N	124° 30' E
Marcou (St.) Isle, France	49° 30' N	1° 9' W	Mindoro Isle, Calavite Pt., Philip. Isles	13° 27' N	120° 29' E
Margarita I., Cape Isla, Caribbee Sea	11° 10' N	63° 58' W	Minehead Steeple, England	51° 13' N	3° 28' W
— C. Robledar, Carib. Sea	11° 2' N	64° 29' W	Minicoy Isle, Laccadives	8° 17' N	73° 18' E
Maria (St.) Cape, Paraguay	34° 40' S	53° 54' W	Mirepoix Observatory, France	43° 5' N	1° 52' E
Maria (St.) Cape, Portugal	36° 56' N	7° 49' W	Mirik Cape, W. Coast of Africa	19° 4' N	16° 12' W
Maria (St.) Quay, Lucayos	22° 39' N	78° 56' W	Mississippi River, S.E. Ent., United S.	28° 57' N	89° 13' W
Marienburg, Prussia	54° 2' N	19° 2' E	Mittau, Russia in Europe	56° 39' N	23° 43' E
Mariere Isle, Pacific Ocean	4° 19' N	132° 28' E	Mobile Point, Florida	30° 10' N	88° 0' W
Marigalante I., S. Point, Caribbee I.	15° 51' N	61° 19' W	Mocha, Arabia	13° 20' N	43° 20' E
Mariguana Isle, S.W. Point, Lucayos	22° 22' N	73° 10' W	Mohilew, Russia in Europe	53° 54' N	30° 5' E
Marikan Isle, Kurile Isles	46° 50' N	152° 30' E	Mohilla I., Centre, Mozambique Chan.	12° 40' S	45° 0' E
Maritimo Isle, the Castle, Mediter.	38° 1' N	12° 4' E	Mombas Harb., Ent., E. C. of Africa	4° 4' S	40° 2' E
Markoe Isle, Lighthouse, Norway	57° 59' N	6° 59' E	Mona Isle, Caribbee Sea	18° 6' N	67° 50' W
Marmara Isle, Turkey in Asia	40° 37' N	27° 31' E	Mondego Cape, Portugal	40° 12' N	8° 54' W
Marseilles Observatory, France	43° 18' N	5° 22' E	Money's Isle, Paracels	16° 29' N	111° 30' E
Marstrand Isle, Lighthouse, Sweden	57° 54' N	11° 36' E	Mongat Fort, Spain	41° 28' N	2° 17' W
Martha (St.), Terra Firma	11° 20' N	74° 8' W	Mongon Cape, the Tower, Spain	42° 7' N	3° 10' E
Martin (St.) I., Daymark, Scilly Isles	49° 58' N	6° 15' W	Monopoli, Italy	40° 56' N	16° 58' E
Martin (St.) I., N.W. Pt., Caribbee I.	18° 4' N	63° 14' W	Montagu Cape, Sandwich Land	58° 33' S	26° 46' W
Martin de Rhé (St.), France	46° 12' N	1° 22' W	Montaigu, Netherlands	50° 59' N	4° 59' E
Martinico I., Fort Royal, Caribbee I.	14° 36' N	61° 6' W	Montalto, Italy	43° 0' N	13° 35' E
Martin-Vas Rocks, the largest, Atlantic	20° 28' S	28° 41' W	Montaram Isles, Indian Archipelago	2° 31' S	108° 45' E
Mary (St.) Cape, Italy	39° 47' N	18° 23' E	Montauban Observatory, France	44° 1' N	1° 21' E
Mary (St.) Isle, S.E. Point, Azores	36° 57' S	25° 18' W	Monte-Christo Isle, Mediterranean	42° 20' N	10° 18' E
Masafuero Isle, Pacific Ocean	33° 45' S	80° 37' W	Montego Bay, Jamaica	18° 30' N	77° 54' W
Massowa Bay, Abyssinia	15° 34' N	39° 37' E	Montery, New Albion	36° 36' N	121° 51' W
Masulipatam, India	16° 11' N	81° 13' E	Monteval Cape, Arabia	17° 26' N	55° 20' E
Matanza Peak, Cuba	23° 2' N	81° 45' W	Montevideo Lighthouse, Paraguay	34° 53' S	56° 13' W
Matapan Cape, Turkey in Europe	36° 23' N	22° 29' E	Mont-Lauro, Spain	42° 46' N	8° 57' W
Mataro, Spain	41° 32' N	2° 27' E	Montpelier Observatory, France	43° 36' N	3° 53' E
Matelota Isle, largest I., Pacific Ocean	8° 17' N	137° 34' E	Montrose, Switzerland	45° 56' N	7° 53' E
Matifou Cape, Barbary	36° 51' N	3° 13' E	Montserrat Isle, N.E. Pt., Caribbee I.	16° 48' N	62° 13' W
Matsumay, Jesso	41° 32' N	140° 4' E	Monza, Italy	45° 35' N	9° 17' E
Matthew's (St.) Lighthouse, France	48° 20' N	4° 46' W	Moose Fort, New Wales	51° 16' N	80° 56' W
Mauritius Isle, Port Louis, Ind. Ocean	20° 10' S	57° 28' E	Morales, Terra Firma	8° 15' N	74° 1' W

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Morant Point, Jamaica	17° 58' N	76° 8' W	Nevers, France	46° 59' N	3° 10' E
Morant Quays, N. E. Quay, Carib. Sea	17° 26' N	75° 54' W	Nevis Isle, S. Point, Caribbee Isles...	17° 5' N	62° 33' W
Morebat Cape, Arabia	17° 0' N	54° 32' E	New Bank, Caribbee Sea	15° 52' N	78° 40' W
Morillos (los) Cape, Porto Rico	17° 58' N	67° 11' W	Newark Steeple, England	53° 4' N	0° 49' W
Mornington I., C. V. Diem., New Hol.	16° 32' S	139° 50' E	Newbiggin Spire, England	55° 11' N	1° 30' W
Mornington Port, Nubia	18° 16' N	38° 32' E	Newbury Steeple, England	51° 24' N	1° 19' W
Morotoi Isle, Sandwich Isles	21° 10' N	157° 17' W	Newenham Cape, N.W. C. of Amer.	58° 41' N	162° 19' W
Morshom Island, S. Point, White Sea.	66° 40' N	43° 27' E	Newhaven, United States	41° 17' N	72° 59' W
Mortory Isle, Sardinia	41° 5' N	9° 36' E	Nice, Italy	43° 41' N	7° 17' E
Morty Isle, N. Pt., Indian Archipelago	2° 44' N	128° 25' E	Nicholas (St.), N. Pt., Cape Verd Isles	16° 43' N	24° 32' W
Morup-Tango, Sweden	56° 56' N	12° 22' E	Nicholas (St.) Mole, St. Domingo...	19° 49' N	73° 30' W
Moscow, Russia in Europe	55° 46' N	37° 33' E	Nicobar Isle (Gt.), S. Pt., Bay of Beng.	6° 45' N	94° 0' E
Mosdox, Russia in Europe	43° 44' N	43° 50' E	Nidingen Isle, Sweden	57° 18' N	11° 55' E
Mossel Bay, Cape St. Blaize, Africa ..	34° 10' S	22° 7' E	Nieuport, Netherlands	51° 8' N	2° 45' E
Mouch Car Banks, N. E. Pt., S. Bk., Luc.	21° 6' N	70° 30' W	Nimeguen, Netherlands	51° 51' N	5° 51' E
— N.W. Pt., S. Bk., Luc 21	0' N	70° 52' W	Ningpo, China	29° 58' N	120° 18' E
Moulin's Point, Spain	36° 37' N	4° 28' W	Nippon Island, S.W. End, Japan Isles	34° 24' N	132° 10' E
Mount Cape, W. Coast of Africa	6° 44' N	11° 20' W	Nismes, France	43° 50' N	4° 22' E
Mowee Isle, E. Pt., Sandwich Isles ..	20° 50' N	156° 2' W	Nizhnei-Novogorod, Russia in Europe	56° 20' N	44° 28' E
Mozambique Harbour, the Isle, Africa	15° 1' S	40° 47' E	Nizhnei-Oudinsk, Russa in Europe ..	54° 55' N	99° 2' E
Mugeris Isle, Centre, Gulf of Mexico.	21° 15' N	86° 39' W	Nocera, Italy	43° 7' N	12° 46' E
Mulas Point, Cuba	21° 11' N	75° 38' W	Noir Cape, Tierra del Fuego	54° 31' S	73° 16' W
Mulgrave Cape, Behring's Straits ..	67° 45' N	165° 12' W	Noirmoutier Isle, France	47° 0' N	2° 14' W
Mulgrave Port, N.W. Coast of Amer.	59° 34' N	139° 42' W	Noahevah I., Anna Maria Port, Marq.	8° 54' S	140° 5' W
Mulhausen, Germany	51° 13' N	10° 29' E	— Marquesas 8° 57' S	139° 39' W	
Mulheim, Germany	47° 49' N	7° 38' E	Nootka Sound, N.W. Coast of Amer.	49° 35' N	126° 37' W
Mull of Cantire, Scotland	55° 17' N	5° 41' W	Norburg, Denmark	55° 45' N	9° 46' E
Mull of Galloway, Scotland	54° 38' N	4° 50' W	Nordlingen, Germany	48° 51' N	10° 28' E
Mumbles Lighthouse, England	51° 34' N	3° 57' W	Norfolk Isle, Pacific Ocean	29° 2' S	168° 10' E
Munich, Germany	48° 8' N	11° 34' E	Norkoping, Sweden	58° 35' N	16° 11' E
Munster, Germany	51° 58' N	7° 36' E	Norriton, United States	40° 10' N	75° 33' W
Muscat Cove, Arabia	23° 35' N	58° 41' E	Norr Telje, Sweden	59° 46' N	18° 39' E
Mussendom Cape, Arabia	26° 21' N	56° 38' E	North Cape, South Georgia	54° 5' S	38° 15' W
Muyden, Netherlands	52° 20' N	5° 4' E	North Cape, Lapland	71° 10' N	26° 1' E
Muzo, Terra Firma	5° 24' N	74° 23' W	— New Zealand	34° 26' S	173° 1' E
Mytelene Island Sigri, Archipelago...	39° 13' N	25° 41' E	— Russia in Asia	68° 56' N	179° 11' W
Nabon Cape, Persia	27° 24' N	52° 52' E	North Isle, Indian Archipelago	5° 41' S	105° 49' E
Narden, Netherlands	52° 18' N	5° 10' E	North Shoal, Paracels	17° 6' N	111° 29' E
Nagel Island, N. Coast of Lapland ..	68° 25' N	37° 35' E	North West Cape, New Holland ..	21° 50' S	114° 28' E
Namo Harbour, Passage Isle, China ..	21° 35' N	112° 33' E	Noss Head, Scotland	58° 30' N	3° 9' W
Namur, Netherlands	50° 28' N	4° 51' E	Noto Cape, Japan	37° 39' N	137° 35' E
Nancy, France	48° 42' N	6° 11' E	Nottingham Steeple, England	52° 52' N	1° 8' W
Nangasaki, Japan	32° 44' N	129° 52' E	Novara, Italy	45° 27' N	8° 38' E
Nankin, China	32° 5' N	118° 47' E	Novogorod, Russia in Europe	58° 32' N	31° 16' E
Nantes, France	47° 13' N	1° 33' W	Noyon, France	49° 35' N	3° 1' E
Nantucket Light, United States	41° 23' N	70° 6' W	Nuremberg, Germany	49° 27' N	11° 4' E
Naples, Italy	40° 50' N	14° 16' E	Nurtingen, Germany	48° 38' N	9° 19' E
Naranjos Quay, Centre, Lucayos ..	24° 55' N	79° 4' W	Oby Isle, Indian Archipelago	8° 25' N	104° 54' E
Narbonne, France	43° 11' N	3° 0' E	Ocana, Spain	39° 57' N	3° 31' W
Narcondam Isle, Bay of Bengal	13° 24' N	94° 12' E	Oczakou, Russia in Europe	46° 37' N	31° 26' E
Narreeenda Bay, Madagascar	14° 31' S	47° 45' E	Odemira, the Bar, Portugal	38° 39' N	8° 50' W
Narra, Russia in Europe	59° 23' N	28° 14' E	Odessa, Russia in Europe	46° 30' N	30° 45' E
Natal Port, E. Coast of Africa	29° 55' S	31° 28' E	Oerebro, Sweden	59° 17' S	15° 13' E
Natunas (Great), S. End, Chinese Sea	3° 45' N	108° 15' E	Oheteroa Isle, Pacific Ocean	22° 27' S	150° 49' W
Navasa Isle, St. Domingo	18° 22' N	75° 8' W	Ohitahoo I., Resolution Bay, Marquesas	9° 55' S	139° 8' W
Navidad Bank, Centre, Lucayos	20° 4' N	68° 44' W	Okhotsk, Russia in Asia	59° 20' N	143° 14' E
Navigator's Island, E. Pt., Friendly I.	14° 9' S	169° 2' W	Okosir Isle, Sea of Tartary	42° 9' N	139° 30' E
Naze, Norway	57° 58' N	7° 3' E	Oland Isle, N. Cape, Sweden	57° 22' N	17° 6' E
Necker Isle, Sandwich Isles	23° 34' N	164° 32' W	— S. Cape Lighth., Sweden	56° 13' N	16° 24' E
Needles Lighthouse, England	50° 40' N	1° 34' W	Oldenburg, Germany	53° 9' N	8° 15' E
Negapatam Port, India	10° 45' N	79° 55' E	Oleron, France	43° 11' N	0° 36' E
Negrais Cape, India	16° 2' N	94° 13' E	Olonne Shoals, W. Coast of France ..	46° 30' N	1° 47' W
Negril N., Jamaica	18° 24' N	78° 30' W	Ombay Isle, N.W. End, Indian Arch.	8° 9' S	124° 27' E
Negro Cape, W. Coast of Africa	16° 1' S	11° 54' E	Omer (St.), France	50° 45' N	2° 15' E
Negro Cape Island, United States ..	43° 33' N	65° 18' W	Ooneheou Island, Sandwich Isles ..	21° 46' N	160° 13' W
Neechin, Russia in Europe	51° 3' N	31° 50' E	Onalashka I., Smg. Hb., N.W. C. of Am.	53° 54' N	166° 22' W
Neustadt, Germany	47° 48' N	16° 14' E	Onemark Cape, N.W. C. of America	54° 30' N	165° 31' W
Neuwerk Isle, Germany	53° 55' N	8° 31' E	Opapa Isle, Pacific Ocean	27° 36' S	144° 9' W

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.			Names of Places.		
	Lat.	Long.		Lat.	Long.
Oporto, the Bar, Portugal	41° 9' N	8° 37' W	Paros Isle, Mt. St. Elias, Archipelago	37° 3' N	25° 11' E
Oran, St. Croix Castle, Barbary	35° 44' N	0° 39' W	Parshongshan, S.W. End, Chinese Sea	23° 41' N	124° 9' E
Orange, France	44° 8' N	4° 48' E	Passado Cape, Peru	0° 27' S	80° 19' W
Orchilla Isle, Caribbee Sea	11° 52' N	66° 6' W	Passandava Bay, Madagascar	13° 45' S	48° 23' E
Oregrund, Sweden	60° 20' N	18° 26' E	Passaro Redoubt, Sicily	36° 42' N	15° 9' E
Orel, Russia in Europe	52° 57' N	35° 57' E	Passoo Keah Isle, Paracels	16° 6' N	111° 46' E
Orenburg, Russia in Asia	51° 46' N	55° 5' E	Pasto, Terra Firma	1° 13' N	77° 21' W
Orford Cape, N.W. Coast of America	42° 52' N	124° 25' W	Pat-chou I., Easternmost I., Pacific O.	24° 42' N	125° 36' E
Orfordness Lighthouse, England	52° 5' N	1° 34' E	Westernmost I., Pacif. O.	24° 17' N	123° 45' E
Orizava Peak, Mexico	19° 2' N	97° 15' W	Patience Cape, Sachalin	48° 52' N	144° 46' E
Orlando Cape, Sicily	38° 8' N	14° 44' E	Patrick's (St.) Head, Van Diemen's I.	41° 42' S	148° 24' E
Orleans, France	47° 54' N	1° 55' E	Patriford, Iceland	65° 36' N	24° 10' W
Orleans (New), United States	29° 58' N	90° 11' W	Patta, E. Coast of Africa	2° 10' S	41° 18' E
Orlognose Cape, Russia in Europe	67° 15' N	41° 15' E	Paul (St.), Brazil	23° 33' S	46° 39' W
Orme's Head (Great), Wales	53° 20' N	3° 50' W	Paul's (St.) Cape, W. Coast of Africa	5° 44' N	1° 7' E
Ormus Isle, N. End, Gulf of Persia	27° 7' N	56° 37' E	Paul's (St.) Isle, Indian Ocean	38° 42' S	77° 18' E
Oropesa Cape, Spain	40° 6' N	0° 8' E	Paul's (St.) Rocks, Atlantic Ocean	0° 55' N	29° 30' W
Orregrund Isle Light., Russia in Eu.	60° 15' N	26° 35' E	Paul-de-Leon (St.), France	48° 41' N	3° 58' W
Orsk, Russia in Asia	51° 12' N	58° 31' E	Paul-de-Loando (St.) W. Coast of Afr.	8° 47' S	13° 53' E
Ortegal Cape, Spain	43° 47' N	7° 49' W	Paul-trois-Chateaux (St.), France	44° 21' N	4° 46' E
Orua Isle, N.W. Point, Caribbee Isles	12° 38' N	70° 10' W	Pavia, Italy	45° 11' N	9° 10' E
SE. Point, Caribbee Isles	12° 25' N	69° 59' W	Payta Point, Peru	5° 3' S	81° 2' W
Osimo, Italy	43° 30' N	13° 27' E	Pednathia's Head, Scilly Isles	49° 52' N	6° 23' W
Osnaaburg, Germany	52° 17' N	8° 1' E	Pedro Shoals, El Cascabel, Caribbee S.	17° 24' N	78° 56' W
Ostaschoff, Russia in Europe	57° 10' N	33° 12' E	Pedro Quays, Caribbee S.	17° 1' N	77° 38' W
Ostend, Netherlands	51° 14' N	2° 55' E	Sola Isle, Caribbee Sea	17° 8' N	77° 20' W
Osterode, Germany	51° 44' N	10° 17' E	Pedro Branco Isle, Chinese Sea	22° 19' N	115° 8' E
Oster-Risoer, Norway	58° 42' N	9° 19' E	Pedro Branco Isle, Indian Archipelago	1° 20' N	104° 25' E
Ost-Hannar, Sweden	60° 14' N	18° 23' E	Pekin Imperial Observatory, China	39° 54' N	116° 28' E
Otaheite Isle, Venus Point, Pacific O.	17° 29' S	149° 30' W	Pelagos Island, Gulf of Venice	42° 29' N	16° 24' E
Otranto, Italy	40° 9' N	18° 29' E	Pelew Isles, Kyangle I., Pacific Ocean	8° 8' S	134° 50' E
Otway Cape, New Holland	38° 51' S	143° 30' E	S. Pt. of Angour I., Pac.O.	6° 53' N	134° 21' E
Ower Rocks, England	50° 40' N	0° 40' W	Pello, Lapland	66° 48' N	23° 58' E
Owhyhee Isle, N. Pt., Sandwich Isles	20° 17' N	155° 59' W	Pembroke Cape, Hudson's Straits	62° 57' N	82° 36' W
S. Pt., Sandwich Isles	18° 54' N	155° 45' W	Penas Cape, Spain	43° 42' N	4° 46' W
Oxford Observatory, England	51° 46' N	1° 15' W	Peniscola, Spain	40° 23' N	0° 29' E
Padang Head, Sumatra	0° 56' S	99° 58' E	Penobscot, United States	44° 24' N	68° 45' W
Padaran Cape, W. Coast of Africa	6° 14' S	12° 40' E	Penrith Beacon, England	54° 41' N	2° 44' W
Paderborn, Germany	51° 44' N	8° 44' E	Penrhyn's Island, Pacific Ocean	9° 12' S	157° 43' W
Padua Observatory, Italy	45° 24' N	11° 52' E	Pensacola, United States	30° 24' N	87° 11' W
Paimbeuf, France	47° 17' N	2° 2' W	Pentland Skerries, Orkney Isles	58° 43' N	3° 3' W
Paix Port, St. Domingo	19° 55' N	72° 53' W	Pera Cape, Majorca	39° 42' N	3° 32' E
Palamos, Spain	41° 51' N	3° 5' E	Pera Isle, Straits of Malacca	5° 42' N	99° 1' E
Palavan Isle, Long Pt., Philippine I.	9° 38' N	118° 22' E	Perceval Cape, Falkland Isles	51° 46' S	61° 11' W
Table Mountain, Phil. I.	10° 48' N	119° 24' E	Perekop, Crimea	46° 9' N	33° 42' E
Palermo Observatory, Sicily	38° 7' N	13° 22' E	Perigueux, France	45° 11' N	0° 44' E
Palliser Cape, New Zealand	41° 38' S	175° 23' E	Perinaldo, Italy	43° 53' N	7° 44' E
Palliser's Island, Pacific Ocean	15° 38' S	146° 29' W	Perm, Russia in Europe	58° 1' N	56° 26' E
Palma, Majorca	39° 34' N	2° 39' E	Pernambuco, Fort Picao, Brazil	8° 3' S	34° 54' W
Palma Isle, N. Point, Canaries	28° 54' N	17° 53' W	Peros Banhos Isles, Centre, Indian O.	5° 23' S	71° 57' E
Palmas Cape, W. Coast of Africa	4° 23' N	7° 38' W	Perotte, Mexico	19° 33' N	97° 13' W
Palmerston's Isle, Pacific Ocean	18° 0' S	163° 12' W	Perouse, Italy	43° 7' N	12° 22' E
Palmyras Point, India	20° 44' N	87° 6' E	Perpignan, France	42° 42' N	2° 54' E
Palmyra Point, Ceylon	9° 49' N	80° 26' E	Pesaro, Italy	43° 55' N	12° 54' E
Palos Cape, Spain	37° 37' N	0° 41' W	Petalan Morro, Mexico	17° 32' N	101° 21' W
Pamiers, France	43° 7' N	1° 37' E	Peter's (St.) Island, Indian Ocean	9° 22' S	51° 45' E
Pamplona, Spain	42° 50' N	1° 41' W	Peter's (St.) Isl. Town, Newfoundland	46° 46' N	56° 10' W
Panama, Terra Firma	8° 59' N	79° 27' W	Peterborough Cathedral, England	52° 36' N	0° 15' W
Panaria Isle, Mediterranean	38° 38' N	15° 1' E	Petersburg, Russia in Europe	59° 56' N	30° 19' E
Panay Isle, Point Nasog, Philippine I.	10° 25' N	122° 6' E	Petropaulowskoi-Ostrog, Kamtschatka	53° 0' N	158° 49' E
Pangootaran Isle, Indian Archipelago	6° 15' N	120° 40' E	Pettaw, Germany	46° 26' S	15° 59' E
Pantellaria Isle, Mediterranean	36° 51' N	11° 4' E	Peyster's Isles, S. Point, Pacific Ocean	8° 5' S	178° 17' E
Papoul (St.), France	43° 20' N	2° 38' E	Philadelphia, United States	39° 57' N	75° 11' W
Paquet Harbour, Newfoundland	50° 8' N	55° 53' W	Philip Isles, Pacific Ocean	8° 6' N	140° 3' E
Para, Brazil	1° 28' S	48° 40' W	Philippeville, France	50° 11' N	4° 33' E
Parcelar Hill, India	2° 52' N	101° 29' E	Philippine, Netherlands	51° 17' N	3° 45' E
Paris, Royal Observatory, France	48° 50' N	2° 20' E	Philipsburg, Germany	49° 14' N	8° 27' E
Parma, Italy	44° 48' N	10° 27' E	Piacenza, Italy	45° 3' N	9° 43' E
			Pianosa Isle, Mediterranean	42° 35' N	10° 6' E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Pickersgill's Harbour, New Zealand.	45° 47' S	166° 18' E	Prince's I., the Port, Atlantic Ocean.	1° 37' N	8° 14' E
Pickersgill's Isle, South Georgia.	54° 42' S	36° 58' W	Pr. Edward's I., Charlotte Town, Gulf of St. Lawrence.	46° 14' N	62° 56' W
Pico Isle, the Peak, Azores.	38° 28' N	28° 33' W	Prince Edward's I., Largest, Indian O.	46° 53' S	37° 46' E
Pierre (St.) Isle, Centre, Newfoundland.	46° 48' N	56° 12' W	Pr. of Wales' Cape, NW. Cst. of Amer.	65° 45' N	168° 17' W
Pigeon Isle, India.	14° 3' N	74° 32' E	Prince of Wales' Fort, New Wales.	58° 48' N	94° 14' W
Pilier Isle, France.	47° 3' N	2° 21' W	Pr. of Wales' I. Fort, Corn. S. of Malac.	5° 24' N	100° 21' E
Pillar Cape, Patagonia.	52° 46' S	74° 54' W	Prince Wm. Henry's I., Pacific Ocean.	19° 0' S	141° 22' W
Pillar Cape, Van Diemen's Land.	43° 12' S	148° 5' E	Prior Cape, Spain.	43° 34' N	8° 22' W
Pillau, Prussia.	54° 34' N	19° 52' E	Providence, United States.	41° 51' N	71° 20' W
Pilsen, Germany.	49° 45' N	13° 23' E	Providence Isle (Little), Pacific Ocean.	0° 11' S	135° 12' E
Pine's Island, New Caledonia.	22° 38' S	167° 38' E	Providence I. Nassau Lighth., Lucayos.	25° 5' N	77° 19' W
Piombino, Italy.	42° 55' N	10° 31' E	Pulo Laut, Great, NE. Pt., Macassar St.	3° 23' N	116° 41' E
Pisa Observatory, Italy.	43° 43' N	10° 24' E	Purraque Volcano, Chili.	41° 16' S	72° 50' W
Piscadores Isles, largest Isle, Chin. Sea.	23° 32' N	119° 46' E	Pylstaart Isle, Friendly Isles.	22° 23' S	175° 49' W
Pitcairn's Isle, Pacific Ocean.	25° 4' S	130° 25' W	Quebec, Canada.	46° 47' N	71° 10' W
Piton Rock's, Canaries.	30° 2' N	16° 17' W	Quedlinburg, Germany.	51° 48' N	11° 8' E
Pittsburgh, United States.	40° 26' N	79° 58' W	Qu. Charlotte's Cape, New Caledonia.	22° 15' S	167° 13' E
Planier Isle, France.	43° 12' N	5° 14' E	Queen Charlotte's Sound, New Zealand.	41° 6' S	174° 21' E
Plata, Peru.	2° 23' S	75° 52' W	Quelapaert Isle, Corea.	33° 8' N	126° 19' E
Plata Isle, Peru.	1° 18' S	80° 56' W	Quemada Point, Patagonia.	50° 18' S	68° 30' W
Plettenberg Bay, Cape Seal, Africa.	34° 6' S	23° 22' E	Quentin (St.), France.	49° 51' N	3° 18' E
Plymouth New Church, England.	50° 22' N	4° 7' W	Queretaro, Mexico.	20° 37' N	100° 10' W
Plynlimmon Mountain, Wales.	52° 28' N	3° 46' W	Quicara Isle, Pacific Ocean.	7° 15' N	81° 39' W
Poitiers, France.	46° 35' N	0° 21' E	Quilmane River, East Coast of Africa.	18° 10' S	37° 30' E
Pola, Istria.	44° 52' N	13° 50' E	Quiloa, East Coast of Africa.	8° 41' S	39° 47' E
Pollingen, Germany.	47° 48' N	11° 9' E	Quilon Point, India.	8° 52' N	76° 48' E
Polotz, Russia in Europe.	55° 29' N	28° 48' E	Quimper, France.	47° 58' N	4° 6' W
Polten (St.), Germany.	48° 12' N	15° 36' E	Quiros Island, Friendly Isles.	10° 40' S	169° 54' W
Pomona, Orkney Islands.	58° 59' N	3° 23' W	Quito, Peru.	0° 13' S	78° 45' W
Pondicherry, India.	11° 56' N	79° 54' E	— Peru.	0° 13' S	78° 21' W
Pondy Isle, Indian Archipelago.	7° 0' S	113° 40' E	Race Cape, Newfoundland.	46° 40' N	53° 3' W
Ponoi, Russia in Europe.	67° 5' N	41° 9' E	Radstock Cape, New Holland.	33° 12' S	134° 15' E
Pons (St.), France.	43° 32' N	2° 44' E	Ragged Point, Borneo.	2° 10' S	116° 48' E
Poole Church, England.	50° 43' N	1° 59' W	Ragusa, Dalmatia.	42° 39' N	18° 6' E
Popayan, Terra Firma.	2° 26' N	76° 40' W	Ram Head, England.	50° 19' N	4° 12' W
Popo Isle, SE. Pt., Indian Archipelago.	1° 12' S	129° 52' E	Ramea Isles, Newfoundland.	47° 32' N	57° 24' W
Porkala-Udd Cape, Russia in Europe.	59° 56' N	24° 27' E	Ramsey Isle, highest Point, Wales.	51° 52' N	5° 20' W
Porquerolles Citadel, France.	43° 0' N	6° 12' E	Ramus Cape, India.	15° 5' N	74° 6' E
Port Jackson, Nova Scotia.	44° 10' N	64° 28' W	Ranai, Sandwich Isles.	20° 46' N	156° 55' W
Port Lewis, France.	47° 43' N	3° 21' W	Randers, Denmark.	56° 28' N	10° 4' E
Port-au-Prince, Fort Ilet, St. Domingo.	18° 34' N	72° 27' W	Raoul Isle, NW. Point, Pacific Ocean.	29° 16' S	181° 56' E
Portland Cape, Van Diemen's Land.	40° 44' S	147° 56' E	Rasalgat Cape, Arabia.	22° 22' N	59° 58' E
Portland Isle, Iceland.	63° 22' N	18° 54' W	Ras-el-Ans Cape, Egypt.	23° 56' N	35° 48' E
Portland Isles, Easternmost I., Pacific O.	2° 36' S	149° 39' E	Ras-Mahomed Cape, Arabia.	27° 43' N	34° 15' E
Port Mahon, Minorca.	39° 52' N	4° 18' E	Ras-Reccan Cape, Arabia.	26° 11' N	51° 16' E
Portland Lighthouse, England.	50° 31' N	2° 27' W	Ratisbon, Germany.	49° 1' N	12° 4' E
Portland Point, Jamaica.	17° 43' N	77° 2' W	Ratmanoff Cape, Sachalin.	51° 0' N	143° 43' E
Port Patrick Light, Scotland.	54° 48' N	5° 3' W	Rattan Island, E. Pt., Bay of Honduras.	16° 26' N	86° 30' W
Port St. Juan, Vancouver's Isle.	48° 34' N	124° 8' W	Ravenna, Italy.	44° 25' N	12° 11' E
Porto, Italy.	41° 47' N	12° 14' E	Razat Cape, Barbary.	33° 4' N	21° 48' E
Porto Rico, Porto Rico.	18° 29' N	66° 13' W	Real Corona, Terra Firma.	8° 0' N	64° 45' W
Porto-Bello, Terra Firma.	9° 34' N	79° 43' W	Recanati, Italy.	43° 26' N	13° 31' E
— Terra Firma.	9° 33' N	79° 34' W	Recreation Island, Pacific Ocean.	15° 58' S	148° 48' W
Porto-Cabello, Terra Firma.	10° 28' N	68° 17' W	Reculver (South), England.	51° 23' N	1° 12' E
— Castle of St. Philip, T. F.	10° 29' N	68° 5' W	Redondo Cape, Patagonia.	50° 51' S	69° 8' W
Porto-Galete, Spain.	43° 20' N	3° 5' W	Redondo Isle, Caribbee Isles.	17° 1' N	62° 19' W
Porto Santo Island Town, Atlantic Oc.	33° 3' N	16° 17' W	Reikaness Cape, Iceland.	63° 55' N	22° 47' W
Porto Vecchio, Corsica.	41° 35' N	9° 17' E	Remedios Cape, Mexico.	13° 30' N	89° 40' W
Port Royal, Jamaica.	17° 58' N	76° 52' W	Remedios Port, NW. Coast of America.	57° 24' N	135° 54' W
Portsmouth, United States.	43° 4' N	70° 43' W	Rendsburg, Denmark.	54° 19' N	9° 40' E
Portsmouth Observatory, England.	50° 48' N	1° 6' W	Rennes, France.	48° 7' N	1° 41' W
Portuguese Shoals, Indian Ocean.	12° 30' S	46° 47' E	Resolution Isle, Pacific Ocean.	17° 23' S	141° 45' W
Prague, Germany.	50° 5' N	14° 25' E	Resolution I., C. Warwick, Hudson's S.	61° 29' N	65° 16' W
Praslin Port, New Ireland.	4° 49' S	153° 7' E	Retford (East) Spire, England.	53° 24' N	0° 54' W
Pratas Isle, Chinese Sea.	20° 47' N	116° 38' E	Revel, Russia in Europe.	59° 27' N	24° 35' E
Preparis Isle, Centre, Bay of Bengal.	14° 50' N	93° 40' E	Rhè Isle Lighthouse, France.	46° 15' N	1° 33' W
Presburg, Hungary.	48° 8' N	17° 11' E			
Prince's I., Peaked Hill, St. of Sunda.	6° 35' S	105° 15' E			
Prince's I., Port St. Antonio, Atlantic O.	1° 41' N	7° 26' E			

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Rheims, France.....	49 15N	4 3 E	Salamanca, Mexico.....	20 40N	100 56W
Rhiw Mountain, Beacon Ho., Wales.....	52 50N	4 37W	Salatan Cape, Borneo.....	4 10S	114 42E
Rhode Island Light, United States.....	41 27N	71 32W	Salayer Strait, Middle I., Indian Arch.....	5 40S	120 28E
Rhodes Harb., Arab's Tower, Rhodes I.....	36 26N	28 15E	Saldanah Bay, W. Coast of Africa.....	33 7 S	17 58E
Rhodes, France.....	44 21N	2 34E	Salee, Morocco.....	34 5N	6 43E
Ribadeo Port, Pancha Isle, Spain.....	43 35N	6 59W	Salehieh, Egypt.....	30 48N	32 0E
Riche Point, Newfoundland.....	50 40N	57 23W	Salina Isle, Mediterranean.....	38 34N	14 47E
Riesenkuppe, Germany.....	50 43N	15 40E	Salisbury Isle, Hudson's Bay.....	63 29N	76 47W
Rieux, France.....	43 15N	1 12E	Salisbury Spire, England.....	51 4N	1 47W
Riez, France.....	43 49N	6 5E	Salizano Cape, Cyprus.....	35 6N	32 16E
Riga, Russia in Europe.....	56 57N	24 8E	Salo Isle, Lighthouse, Sweden.....	58 21N	11 15E
Rimini, Italy.....	44 4N	12 33E	Salonica, Turkey in Europe.....	48 38N	22 56E
Riobamba Nuevo, Peru.....	1 42S	78 49W	Salt Quay Bank, N.W. Pt., Lucayos.....	24 0N	80 20W
Rio-Janeiro Bay, Rat Isle, Brazil.....	22 53S	43 12W	—— Salt Quay, Lucayos.....	23 41N	80 13W
Ripatransone, Italy.....	43 0N	13 45E	—— S.E. Pt. of Anguilla Qu., Lucayos.....	23 29N	79 22W
Ripon Church, England.....	54 8N	1 31W	Saltsburg, Germany.....	47 48N	13 1E
Rivers Cape, Celebes.....	1 15N	120 34E	Salvador (St.), Ft. St. Anthony, Brazil.....	3 5S	38 28W
Roca Cape, Portugal.....	38 46N	9 30W	Salvages Isles, Atlantic Ocean.....	30 9N	16 3W
Roca Partida Isle, Pacific Ocean.....	18 30N	114 2W	Samana Cape, St. Domingo.....	19 18N	68 59W
Roca Partida Point, Mexico.....	18 44N	94 58W	—— St. Domingo.....	19 16N	69 13W
Roca, N.E. Point, Leeward Islands.....	12 0N	66 15W	Samana Isle, E. Point, Lucayos.....	23 12N	73 35W
Rocheftort, France.....	45 56N	0 58W	—— W. Point, Lucayos.....	23 10N	73 48W
Rochelle, France.....	46 9N	1 10W	Samar Isle, Cape Espir Sant, Philip. I.....	12 40N	125 30E
Rock near Cape Horn.....	40 0S	57 37W	—— S.W. Pt. Batag I., Philip. I.....	12 38N	125 1E
Rodosto, Turkey in Europe.....	40 59N	27 26E	Samara, Russia in Europe.....	48 30N	35 20E
Rodrigue Isle, Indian Ocean.....	19 41S	63 12E	Samarang Bay, Java.....	6 53S	110 34E
Roge (Great) Light, Gulf of Finland.....	59 25N	24 15E	Samboangan, Mindanao.....	6 43N	122 14E
Roman Cape, Terra Firma.....	12 13N	69 35W	Sandaiwood Isle, E. Point, Ind. Arch.....	10 0S	120 35E
Romanzoff Cape, Jesso.....	45 26N	141 34E	Sanders's (Sir C.) Island, Society I.....	17 25S	150 58W
Romberg, Tartary.....	53 26N	141 45E	Sandwich Harbour, Nova Scotia.....	45 8N	61 36W
Rome, Roman College, Italy.....	41 54N	12 30E	Sandwich Island, New Hebrides.....	17 41S	168 33E
Ronaldsha, N. Point, Orkney Islands.....	59 23N	2 34W	Sandwich Cape, New Holland.....	18 19N	146 29E
Rondo Isle, Bay of Bengal.....	6 4N	95 14E	Sandy Island, Indian Ocean.....	15 52N	54 50E
Rondoe Isle, Lighthouse, Norway.....	62 24N	5 35E	Sandy Cape, New Holland.....	24 42E	153 16E
Roque (St.) Cape, Brazil.....	5 10S	35 40W	Sandy Hook Lighth., United States.....	40 25N	74 13W
Rosetta, Egypt.....	31 25N	30 28E	Sanguar Cape, Japan.....	41 16N	140 14E
Rossall Point Landmark, England.....	53 55N	3 2W	San-ho Cape, Cochin China.....	13 44N	109 14E
Rot, Germany.....	47 59N	12 9E	Santa, Peru.....	8 59S	78 53W
Rothenburg, Germany.....	48 30N	8 57E	Santa-Cruz Isle, Cape Byron, Pacif. O.....	10 41S	166 5E
Rotterdam, Netherlands.....	51 55N	4 29E	Santa-Cruz Isle, the Port, Caribbee I.....	14 42N	64 48W
Rotuma Isle, Pacific Ocean.....	12 30N	177 50E	Santa-Fé, Mexico.....	36 12N	104 53W
Rouen, France.....	49 26N	1 6E	Santa-Fé de Bogota, Terra Firma.....	4 36N	74 14W
Round Isle, N.W. Coast of America.....	58 56N	159 53W	Santa-Manza Tower, Corsica.....	41 25N	9 15E
Rour Isle, Pacific Ocean.....	1 34S	143 13E	Santander Bar, Mexico.....	23 45N	98 6W
Roveredo, Germany.....	45 56N	11 1E	Santander Port, the Mole, Spain.....	43 28N	3 41W
Royal Captain's Shoal, Chinese Sea.....	9 4N	116 40E	Santa-Reparata Tower, Sardinia.....	41 14N	9 9E
Royan, France.....	45 37N	1 1W	Santona, Spain.....	43 27N	3 20W
Rugged Isle, Philippine Isles.....	11 14N	119 21E	Sapata Isle, E. Point, Chinese Sea.....	10 4N	109 13E
Rumoreunde, Germany.....	51 12N	5 59E	Saratof, Russia in Europe.....	51 31N	46 0E
Ruttunpour, India.....	22 16N	82 36E	Sark Isle, English Channel.....	49 24N	2 24W
Ryacotta, India.....	12 31N	78 4E	Sarlat, France.....	44 53N	1 13E
Rypen, Denmark.....	55 20N	8 47E	Saros Rock, Archipelago.....	40 37N	26 42E
Saba Isle, Ladder Point. Carib. Isles.....	17 39N	63 18W	Sarytscheff Peak, Kuriles.....	48 6N	153 12E
Saionetta, Italy.....	45 0N	10 30E	Saunders Cape, New Zealand.....	45 58S	170 16E
Sable Cape, Florida.....	25 2N	81 15W	Savage Isle, Pacific Ocean.....	19 2S	169 30E
Sable Cape, Nova Scotia.....	43 24N	65 30W	Savanna Lighthouse, United States.....	32 1N	80 56W
Sable Island, E. Point, Nova Scotia.....	44 4N	60 0W	Savanna la Mer, Jamaica.....	18 13N	78 15W
Sables d'Olonne, France.....	46 30N	1 47W	Savu Isle, Centre, Indian Archipelago.....	10 30S	121 43E
Sacratif Cape, Spain.....	36 41N	3 27W	Scala Nuova. I. off the Town, Archip.....	37 50N	27 15E
Saddle-Back Isles, Hudson's Bay.....	62 7N	68 13W	Scarborough Shoal, Centre, Chin. Sea.....	15 8N	117 48E
Saaby, Denmark.....	57 20N	10 33E	Schiedam, Netherlands.....	51 55N	4 24E
Sagan, Germany.....	51 42N	15 22E	Schlukena, Germany.....	51 0N	14 26E
Sageisier Isle, Indian Archipelago.....	0 57S	130 33E	Schmalkalden, Germany.....	50 45N	10 26E
Sahib Isle, Centre, Archipelago.....	38 40N	26 28E	Schnittken, Germany.....	53 48N	21 28E
Saintes, France.....	45 45N	0 38W	Schouen Light, Holland.....	51 39N	3 37E
Saintes Isles, N.W. Pt. of W. I., Car. I.....	15 51N	61 41W	Schulipar Isle, Laccadives.....	10 3N	72 38E
Sal Isle, Lion's Head, Cape Verd Isles.....	16 41N	23 3W	Schwatz, Germany.....	47 23N	11 39E
Salagua, Mexico.....	19 6N	104 28W	Schweidnitz, Germany.....	50 51N	16 27E
			Schwezingen, Germany.....	49 23N	8 34E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Silly Isles, St. Mary's, England.....	49 54N	6 17W	Solidad Port, Falkland Isles.....	51 31S	58 5W
Scio Island Town, Archipelago.....	38 24N	26 5E	Soliman Port, Barbary.....	31 46N	25 7E
Seal Island, South Pt., United States 43 25N		66 1W	Solitary Island, Friendly Isles.....	10 40S	176 0W
Sebastian (St.), Spain.....	43 19N	1 58W	Solombo Isle (Great), Indian Archip. .	5 33S	114 28E
Sebastian (St.) Cape, E. Coast of Africa.	22 5S	35 58E	Solomon Cape, Candia.....	35 9N	26 19E
Se Booro I., SE. Pt., W. Coast of Suma. 1	47 S	99 14E	Sombrero Isle, Caribbee Sea.....	18 38N	63 25W
Seeseeran Port, Luconia.....	14 20N	123 40E	Sonderburg, Denmark.....	54 55N	9 47E
Seez, France.....	48 36N	0 11E	Sonderhausen, Germany.....	51 23N	10 50E
Seieroe Isle, Denmark.....	55 53N	11 10E	Sooloo Isle, Sooloo Town, Ind. Archip. 6	1N	121 12E
Selinginskoi-Ostrog, Russia in Asia..	61 6N	106 39E	Sorsogan Port, Ft. Talutacaban, Luconia	12 52N	123 50E
Selivria, Turkey in Europe.....	41 5N	28 11E	Sourabaya, Java.....	7 14S	112 41E
Selsea Church, England.....	50 45N	0 46W	South Cape, New Zealand.....	47 17S	167 20E
Senegal River, Ent., W. Coast of Africa	15 53N	16 31W	South Cape, Van Diemen's Land.....	43 37S	146 49E
Senex, France.....	43 55N	6 24E	South Cape, Spitzbergen.....	76 32N	13 45E
Senlis, France.....	49 12N	2 35E	Southern Thule, Sandwich Land.....	59 34S	27 45W
Sens, France.....	48 12N	3 17E	South Isle, Pacific Ocean.....	31 30N	140 0E
Se Pora, Pt. Marlbro', W. Ct. of Sumatra	2 25S	99 58E	Southampton I., C. Pembroke, Hud. By.	62 57N	82 0W
Serdze-Kamen Cape, Russia in Asia..	67 3N	171 54W	Southampton Spire, England.....	50 54N	1 24W
Seringapatam, India.....	12 25N	76 42E	Southernness Pt. Landmark, Scotland..	54 52N	3 35W
Serranilla Rocks, Caribbee Sea.....	15 46N	79 56W	Sparogskaija-Sjelza, Russia in Europe..	47 32N	34 23E
Setuval, Portugal.....	38 29N	8 54W	Spartel Cape, Barbary.....	35 48N	5 55W
Seven Capes, N. Cape, Turkey in Asia..	36 23N	29 8E	Spartivento Cape, Italy.....	37 56N	16 4E
Shadwan Isle, SE. End, Red Sea.....	27 26N	33 54E	Speaker's Bank, Indian Ocean.....	4 48S	72 30E
Shan-tung Promont., NE. Pt., China..	37 25N	122 27E	Speard Cape, Newfoundland.....	47 31N	52 38W
Sharga, Arabia.....	25 22N	55 32E	Specia, the Lazaretto, Italy.....	44 4N	9 51E
Sheerness Staff, England.....	51 11N	0 44E	Spencer's Bay, W. Coast of Africa..	25 48S	15 8E
Sherbro' I., Cape St. Ann, W. Ct. of Af. 7	29 12N	12 45W	Spencer Cape, New Holland.....	35 18S	136 53E
Shetland I. (New), C. Smith, Atlan. O. 62	52 S	63 42W	Spichell Cape, Portugal.....	38 25N	9 13W
———— N. Foreland, Atlant. O. 62 0S		57 30W	Spire, Germany.....	49 19N	8 26E
Shipunskoi Noss, Kamtschatka.....	52 55N	159 43E	Spoletto, Italy.....	42 45N	12 36E
Shoebury Ness Staff, England.....	51 31N	0 47E	Sproe Isle, Denmark.....	55 20N	10 59E
Shrewsbury, St. Chad's Steep., England	52 42N	2 45W	Stade, Germany.....	53 37N	9 29E
Siam, India.....	14 21N	100 50E	Staples (East) Lighthouse, England..	55 38N	1 37W
Siao Island Peak, Indian Archipelago .	2 43N	125 35E	Start Point Flagstaff, England.....	50 13N	3 38W
Sienna, Italy.....	43 22N	11 10E	Staunton's Island, China.....	36 47N	122 13E
Sierra Leone Cape, W. Coast of Africa 8	31N	13 18W	Stavanger, Norway.....	58 58N	5 45E
Siezran, Russia in Europe.....	53 10N	48 25E	Steen Ground, Atlantic Ocean.....	32 45N	21 25W
Silinity, the Mausoleum, Turkey in Asia	36 15N	32 19E	Stephen's Cape, NW. Coast of Amer..	63 33N	162 17W
Silver Quay Bank, NE. End, Lucayos..	20 33N	69 28W	Stickhausen, Germany.....	53 13N	7 37E
———— W. End, Lucayos. 20 30N		69 59W	Stockholm, Sweden.....	59 21N	18 3E
———— SE. End, Lucayos.. 20 18N		69 30W	Stolberg, Germany.....	51 35N	10 57E
Sines Castle, Portugal.....	37 57N	8 53W	Strabane, Ireland.....	54 49N	7 23W
Singanfu, China.....	34 17N	108 57E	Stralsund, Germany.....	54 19N	13 32E
Sinigaglia, Italy.....	43 43N	13 12E	Strasbourg, France.....	48 35N	7 45E
Sinope, Turkey in Asia.....	42 2N	34 41E	Stromboli I. St. Bartolo, Mediterranean	38 48N	15 12E
Siout, Egypt.....	27 13N	31 14E	Stromness, Orkneys.....	58 56N	3 31W
Sisteron, France.....	44 12N	5 56E	Stromstadt, Sweden.....	58 55N	11 12E
Skagen Cape Lighthouse, Denmark..	57 44N	10 38E	Stutgard, Germany.....	48 46N	9 11E
Skano, Sweden.....	55 25N	12 50E	Suakin, Nubia.....	19 5N	37 33E
Skiddaw Mountain, England.....	54 39N	3 8W	Success Cape, Tierra del Fuego.....	55 0S	65 19W
Skudenes Lighthouse, Norway.....	59 9N	5 19E	Suez, Egypt.....	30 0N	32 28E
Sledge Isle, Behring's Straits.....	64 30N	166 8E	Suffren Bay, Tartary.....	47 51N	139 33E
Sleswick, Denmark.....	54 31N	9 34E	Sulphur Isle, Chinese Sea.....	27 52N	128 22E
Sluys, Netherlands.....	51 19N	3 23E	Sulphur Isle, Pacific Ocean.....	24 48N	141 20E
Small's Lighthouse, England.....	51 43N	5 39W	Sunderland Lighthouse, England.....	54 55N	1 21W
Smeinagors, Russia in Asia.....	51 9N	82 10E	Sundswall, Sweden.....	62 22N	17 16E
Smith's Isles, Pacific Ocean.....	14 30N	168 42E	Surat River, Vaux's Tomb, India.....	21 4N	72 51E
Smith's Lighthouse, United States.....	37 52N	6 7W	Surigao Isles, Surigo Town, Philipp. I. 9	47N	125 25E
Smoky Cape, New Holland.....	30 55S	153 4E	Suwarrow Isles, Pacific Ocean.....	13 13S	163 31W
Smymna, Centre of Town, Turkey in Asia	38 25N	27 6E	Swallow Shoal, Indian Archipelago ..	7 22N	113 44E
Snare's Isle, Pacific Ocean.....	48 3S	166 20E	Swansea Castle, Wales.....	51 37N	3 56W
Snea Fell, Isle of Man.....	54 17N	4 27W	Swan's I., Largest, Van Diemen's Land	40 43S	148 8E
Snies Castle, Sicily.....	37 57N	13 33E	Swan's Isles, Bay of Honduras.....	17 22N	84 3W
Snowdon Mountain, Wales.....	53 4N	4 4W	Sweetnose Cape, Russia in Europe ..	68 12N	39 46E
Socorro Isle, Pacific Ocean.....	18 40N	110 17W	Syene, Egypt.....	24 5N	32 55E
Socotra Isle, Centre. Arabian Sea.....	12 30N	54 10E	Syra Isle Port, Chapel I., Archipelago.	37 26N	24 55E
Soderarm Beacon, Sweden.....	59 46N	19 26E	Syracuse Lighthouse, Sicily.....	37 3N	15 16E
Soderhamn, Sweden.....	61 18N	17 5E			
Soissons, France.....	49 23N	3 20E	Table Bay, Robin I., S. Coast of Africa	33 48S	18 23E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

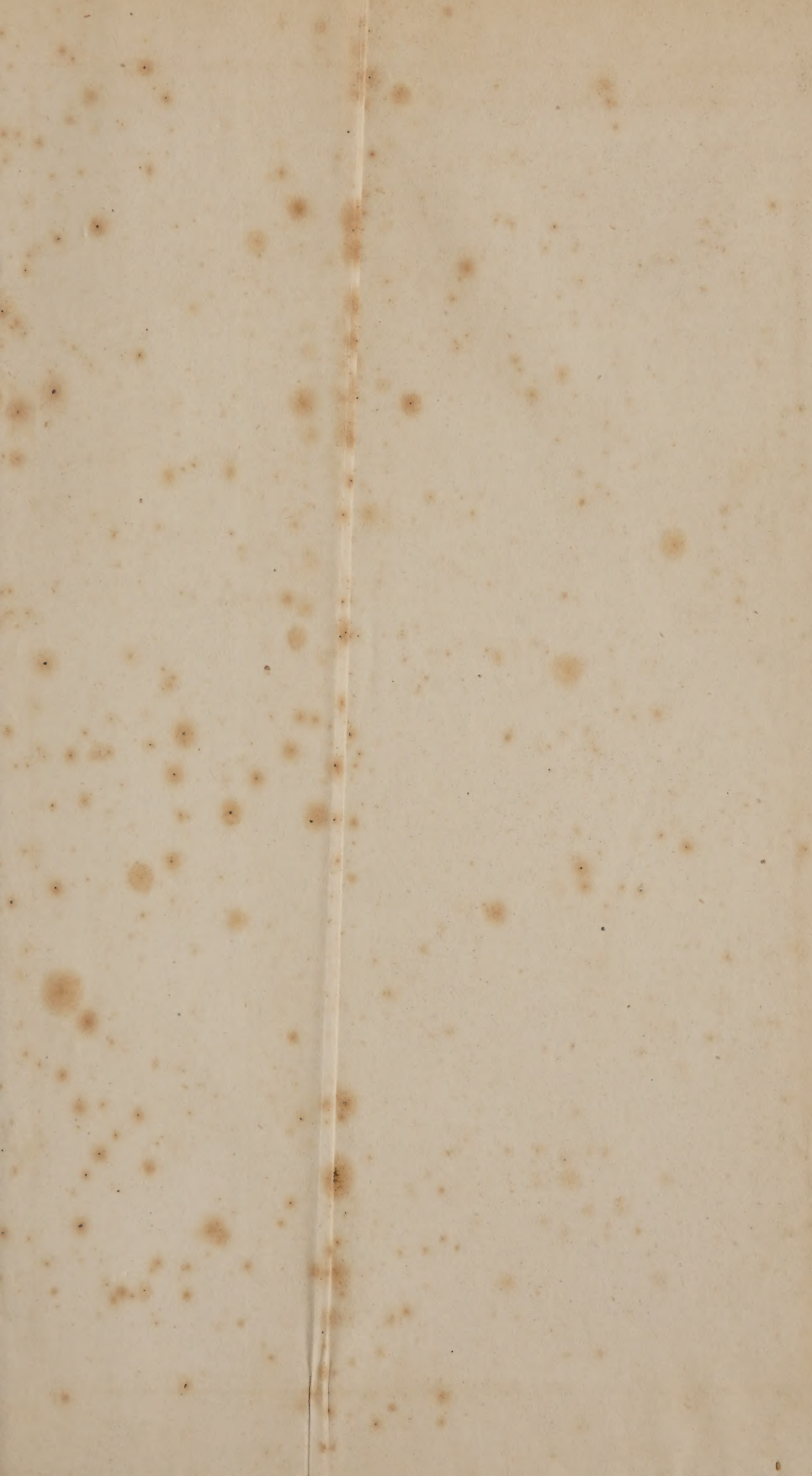
Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Table Island, New Hebrides.....	15° 38' S	167° 7' E	Tinian Isle, Ladrone.....	14° 58' N	145° 51' E
Tacuba, Mexico.....	19° 31' N	99° 8' W	Tobago Isle, N.E. Pt., Caribbee Isles.....	11° 10' N	60° 27' W
Taganrock, Russia in Europe.....	47° 13' N	38° 39' E	Tobolsk, Russia in Asia.....	58° 12' N	68° 6' E
Tagomago Isle, Spain.....	39° 0' N	1° 41' E	Toluca, Mexico.....	19° 16' N	99° 21' W
Talcaguana, Chili.....	36° 42' S	73° 39' W	Tomependa, Peru.....	5° 31' S	78° 36' W
Tambelan Isles, Centre, Indian Arch.....	1° 0' N	107° 40' E	Tomsk, Russia in Asia.....	56° 30' N	85° 10' E
Tambow, Russia in Europe.....	52° 44' N	41° 45' E	Tondern, Denmark.....	54° 56' N	8° 54' E
Tanakeke Isle, Indian Archipelago.....	5° 52' S	119° 19' E	Tongatabou I., Panghaim I. Friendly I.....	1° 21' S	175° 13' W
Tangier Fort Flagstaff, United States.....	37° 47' N	75° 52' W	Tongres, Germany.....	50° 47' N	5° 28' E
Tanna Isle, Port Resolution, New Heb.....	19° 32' S	169° 20' E	Tonningen, Denmark.....	54° 19' N	8° 59' E
————— New Heb.....	19° 32' S	169° 41' E	Toobouai Isle, Pacific Ocean.....	23° 25' S	149° 20' W
Taormina Telegraph, Sicily.....	37° 48' N	15° 18' E	Tor Harbour, Arabia.....	28° 19' N	33° 28' E
Taoukaa Isle, Pacific Ocean.....	14° 30' S	145° 9' W	Torbay, Nova Scotia.....	45° 12' N	61° 16' W
Tapeantana Isle, S.E. Pt., Ind. Arch.....	6° 14' N	122° 8' E	Tornea, Sweden.....	65° 51' N	24° 12' E
Tappanooly Bay, Sumatra.....	1° 40' N	98° 40' E	Torschok, Russia in Europe.....	57° 2' N	35° 3' E
Tara, Russia in Asia.....	56° 55' N	74° 5' E	Tortola Bay, Virgin Isles.....	18° 23' N	64° 39' W
Tarapia, Turkey in Europe.....	41° 8' N	29° 1' E	Tortona, Italy.....	44° 53' N	8° 57' E
Tarbes, France.....	43° 14' N	0° 4' E	Tortosa Cathedral, Spain.....	40° 49' N	0° 33' E
Tarbett Ness, Scotland.....	57° 54' N	3° 47' W	Tortue Isle, S.E. Point, St. Domingo.....	20° 4' N	72° 43' W
Tariffa Isle, Spain.....	36° 0' N	5° 35' W	Tortuga Isle, Centre, Caribbee Sea.....	10° 59' N	65° 34' W
Tarquino Peak, Cuba.....	19° 53' N	76° 50' W	Tory Island, N.W. Point, Ireland.....	55° 17' N	8° 16' W
Tarragona, Spain.....	41° 9' N	1° 15' E	Totma, Russia in Europe.....	60° 8' N	42° 41' E
Tarsus, Turkey in Asia.....	37° 1' N	34° 52' E	Toul, France.....	48° 41' N	5° 53' E
Tasco, Mexico.....	18° 35' N	99° 29' W	Toulon, France.....	43° 7' N	5° 56' E
Taunton, St. Mary's Steeple, England.....	51° 1' N	3° 5' W	Toulouse, France.....	43° 36' N	1° 26' E
Tavastchus, Russia in Europe.....	61° 3' N	24° 26' E	Tournay, Netherlands.....	50° 36' N	3° 23' E
Tavolara Tower, Sardinia.....	40° 55' N	9° 43' E	Tours, France.....	47° 24' N	0° 42' E
Taya Isle, Indian Archipelago.....	0° 45' S	104° 58' E	Trafalgar Cape, Spain.....	36° 10' N	6° 0' W
Taya Isles, Northernmost, Chinese Sea.....	19° 56' N	111° 10' E	Tranquebar, India.....	11° 1' N	79° 55' E
Tayingshan, N.E. Point, Chinese Sea.....	24° 30' N	125° 6' E	Trapani, Sigia Tower, Sicily.....	38° 3' N	12° 30' W
Tchin-san Isles, China.....	30° 20' N	122° 36' E	Travemunde, Germany.....	53° 58' N	10° 52' E
Tedeles Cape, Barbary.....	36° 57' N	4° 14' E	Trebizonde, Turkey in Asia.....	41° 3' N	39° 28' E
Teklenburg, Germany.....	52° 13' N	7° 47' E	Treguier, France.....	48° 47' N	3° 14' W
Telesmaque Shoal, Indian Ocean.....	38° 11' S	21° 58' E	Trelleborg, Sweden.....	55° 22' N	13° 10' E
Tellicherry Flagstaff, India.....	11° 44' N	75° 49' E	Tremiti Isle, Gulf of Venice.....	42° 7' N	15° 29' E
Tenby Spire, Wales.....	51° 40' N	4° 41' W	Trente, Germany.....	46° 6' N	11° 4' E
Ten-choo-foo, China.....	37° 46' N	120° 53' E	Tres Forcas Cape, Barbary.....	35° 28' N	2° 57' W
Tenedos Isle, N.E. Point, Archipelago.....	39° 51' N	25° 53' E	Treves, Germany.....	49° 47' N	6° 38' E
Teneriffe Isle, the Peak, Canary Isles.....	28° 17' N	16° 40' W	Trevose Head, England.....	50° 33' N	5° 1' W
————— Santa Cruz Mole, C. I.....	28° 18' N	16° 16' W	Triangle Isles, Indian Archipelago.....	3° 1' S	117° 53' E
Tercera Isle, Angra, Azores.....	38° 39' N	27° 14' W	Triangle Isles, E. Isle, Gulf of Mexico.....	21° 2' N	92° 5' W
Ternate Isle, Fort Orange, Ind. Arch.....	0° 50' N	127° 32' E	Trieste, Illyria.....	45° 38' N	13° 47' E
Ternay Bay, Tartary.....	45° 11' N	137° 1' E	Trincomalee Bay, Flagstaff Pt., Ceylon.....	8° 33' N	81° 22' E
Terracina, Italy.....	41° 18' N	13° 13' E	Tringhany River, Entrance, India.....	5° 21' N	103° 4' E
Terra-Nova Column, Sicily.....	37° 3' N	14° 16' E	Trinidad, Cuba.....	21° 48' N	80° 1' W
Tescuco, Mexico.....	19° 31' N	98° 51' W	Trinidad Isle, Atlantic Ocean.....	20° 32' N	29° 11' W
Testigos Isles, Caribbee Sea.....	11° 24' N	63° 12' W	Trinidad Isle, Port d'Espagne, Carib.....	10° 39' N	61° 38' W
Texel, S. Point, Holland.....	53° 2' N	4° 33' E	Tripoli, Barbary.....	32° 54' N	13° 12' E
Thaddæus (St.) Noss, Russia in Asia.....	62° 50' N	179° 5' E	Tripoli, Syria.....	34° 26' N	35° 51' E
Thaso Isle, Archipelago.....	40° 47' N	24° 39' E	Tristan d'Aunha Isle, Atlantic Ocean.....	37° 6' S	12° 7' W
Thebes Ruins, Egypt.....	25° 43' N	32° 39' E	Triton Isle, Chinese Sea.....	15° 46' N	111° 11' E
Thiels, Netherlands.....	51° 0' N	3° 20' E	Tropez (St.), France.....	43° 16' N	6° 39' E
Thirsty Sound, Pier Head, New Hol.....	52° 7' S	150° 0' E	Troyes, France.....	48° 18' N	4° 5' E
Thomas (St.) Isle, Harb., Caribbee I.....	18° 20' N	65° 3' W	Truxillo, Mexico.....	15° 51' N	86° 7' W
Thomas (St.) I., Man-of-war Bay, Atlan.....	0° 26' S	6° 44' E	Truxillo, Peru.....	8° 6' S	79° 3' W
Thomas de Nueva-Guya (St.), Guayana.....	8° 8' N	63° 55' W	Tscherkask, Russia in Europe.....	47° 14' N	39° 23' E
Three Points Cape, Patagonia.....	49° 46' S	75° 46' W	Tschirikoff Cape, Japan.....	32° 14' N	131° 41' E
Three Points C., Mid. Pt., W. C. of Af.....	4° 55' S	2° 2' W	Tschitschagoff Cape, Japan.....	30° 57' N	130° 36' E
Thule (South) Cape, Sandwich Land.....	59° 34' S	27° 45' W	Tschukotskoi Noss, Russia in Asia.....	64° 14' N	173° 31' E
Tiburon Cape, St. Domingo.....	18° 19' N	74° 34' W	Tso-Choui, Corea.....	35° 30' N	129° 16' E
Tierra del Esp. Sto. C. Quiros, New Heb.....	56° 16' S	166° 59' E	Tsus-Sima Isle, N. Point, Japan.....	34° 40' N	129° 27' E
————— New Heb.....	56° 16' S	167° 20' E	Tubingen, Germany.....	48° 31' N	9° 4' E
Timana, Terra Firma.....	1° 59' N	75° 52' W	Tula, Russia in Europe.....	54° 12' N	37° 1' E
Timon Isle, N. Point, Indian Arch.....	2° 54' N	104° 15' E	Tulles, France.....	45° 16' N	2° 54' E
Timor Isle, Coupang, Indian Arch.....	10° 10' S	123° 36' E	Tumbado Rock, Lucayos.....	26° 56' N	79° 1' W
————— Delhi, Indian Archipelago.....	8° 35' S	125° 40' E	Tunbridge, England.....	51° 12' N	0° 17' E
Timor Laut Isle, S. Pt., Indian Arch.....	8° 15' S	131° 50' E	Tunis, Fondouc, Barbary.....	36° 48' N	10° 11' E
Ting-hoy Harbour, China.....	26° 10' N	119° 57' E	Turbaco, Terra Firma.....	10° 18' N	75° 22' W
Tinhosa Isle, Chinese Sea.....	18° 46' N	110° 29' E	Turin, Piazza Castello, Italy.....	45° 4' N	7° 40' E

The Latitudes and Longitudes of Remarkable Harbours, Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places	Lat.	Long.
Turk's Isles, N. Pt., Gr. Quay, Lucayos	21° 31' N	71° 4' W	Virgin-Gorda Isle, E. Cape, Carib. I.	18° 31' N	64° 25' W
— Sand Quay, Lucayos	21° 11' N	71° 10' W	Virgin's Cape, Patagonia	52° 21' S	68° 17' W
Turon Cape, Cochín China	16° 8' N	108° 17' E	Virgin Rocks, Newfoundland	47° 9' N	54° 5' W
Turtle Isle, Pacific Ocean	19° 49' S	177° 57' W	Vito (St.) Cape, Sicily	38° 12' N	12° 46' E
Turtle Isles, Indian Archipelago	5° 25' S	127° 38' E	Viviers Observatory, France	44° 29' N	4° 41' E
Twer, Russia in Europe	56° 52' N	35° 57' E	Vizagapatam, India	17° 42' N	83° 26' E
Tynemouth Lighthouse, England	55° 1' N	1° 25' W	Voghera, Italy	44° 59' N	9° 1' E
Tyrnaw, Hungary	48° 23' N	17° 35' E	Volcano Bay, Endormo Harb., Jesso	42° 19' N	141° 8' E
Uddevalla, Sweden	58° 21' N	11° 56' E	Volcano Isle, Japan	30° 43' N	130° 17' E
Udine, Italy	46° 3' N	13° 15' E	Volcano Isle, New Britain	5° 32' S	148° 4' E
Ufa, Russia in Asia	54° 43' N	55° 54' E	Volcano Isle, Pacific Ocean	10° 25' S	165° 48' E
Ulieteta Island, Society Isles	16° 46' S	151° 37' W	Volcano Isle, C. Guardiano, Mediter.	38° 21' N	14° 58' E
Ulm, Germany	48° 23' N	9° 59' E	Vologda, Russia in Europe	59° 13' N	40° 11' E
Umbas, Russia in Europe	66° 44' N	34° 13' E	Volthoen's Isle, Indian Archipelago	5° 58' S	124° 48' E
Umea, Sweden	66° 44' N	20° 22' E	Vona, Turkey in Asia	41° 7' N	37° 47' E
Unst Isle, Shetland	60° 44' N	0° 46' W	Voronetz, Russia in Europe	51° 40' N	39° 21' E
Untiefen Cape, Sachalin	52° 32' N	143° 14' E	Wakefield Spire, England	53° 41' N	1° 29' W
Upsal, Sweden	59° 52' N	17° 39' E	Walcheren Island, W. Point, Holland	51° 32' N	3° 25' E
Urals, Russia in Asia	51° 11' N	51° 35' E	Waldeck, Prussia	51° 13' N	9° 2' E
Urbaniburg, Denmark	55° 55' N	12° 43' E	Waldes Port, Patagonia	42° 30' S	63° 40' W
Urbino, Italy	43° 44' N	12° 37' E	Wallis's Isle, Pacific Ocean	13° 18' S	177° 22' W
Ushant Isle, France	48° 28' N	5° 3' W	Walpole's Island, New Hebrides	22° 39' S	169° 16' E
Ustica Isle, Turk's Peak, Mediter.	38° 45' N	13° 11' E	Walsingham Cape, Cumberland Isle	66° 44' N	60° 51' W
Ust-Kamenorsk, Russia in Asia	49° 57' N	82° 40' E	Walwich Bay, W. Coast of Africa	22° 54' S	14° 40' E
Utklippar Lighthouse, Sweden	55° 58' N	15° 41' E	Wangeroeg Isle, Lighthouse, Germany	53° 48' N	7° 53' E
Uto Isle, Lighth., Russia in Europe	59° 47' N	21° 17' E	Warasdin, Germany	46° 18' N	16° 26' E
Utrecht, Netherlands	52° 6' N	5° 7' E	Warberg Fort, Sweden	57° 6' N	12° 16' E
Uzes, France	44° 1' N	4° 25' E	Wardhuss, Lapland	70° 23' N	31° 7' E
Vabres, France	43° 56' N	2° 51' E	Warmensdorf, Germany	51° 17' N	12° 56' E
Vaison, France	44° 14' N	5° 4' E	Warrington Steeple, England	53° 23' N	2° 33' W
Valdivia, Fort St. Carlos, Chili	39° 50' S	73° 34' W	Warsaw, Russia in Europe	52° 14' N	21° 3' E
Valence, France	44° 56' N	4° 53' E	Washington, United States	38° 55' N	76° 59' W
Valencia, Spain	39° 29' N	0° 23' W	Watcher (North) Isle, Indian Archip.	5° 12' S	106° 32' E
Valery-sur-Somme (St.), France	50° 11' N	1° 38' E	Watecoo Isle, Pacific Ocean	20° 15' S	158° 14' W
Valladolid, Mexico	19° 42' N	100° 52' W	Waterford, Ireland	52° 13' N	7° 10' W
Valona, Turkey in Europe	40° 28' N	19° 26' E	Watling's Isle, S.W. End, Lucayos	23° 56' N	74° 36' W
Valparaiso, Chili	33° 0' S	71° 38' W	Waygate Island, Davis's Straits	70° 40' N	47° 30' W
Vanderlin's I., C. Vanderlin, New Hol.	15° 35' S	137° 9' E	Waygeeo Isle, Pt. Pigot, Ind. Arch.	0° 21' S	131° 18' E
Vannes, France	47° 39' N	2° 45' W	Webuck Cape, Labrador	54° 55' N	57° 40' W
Varela Cape, Cochín China	12° 53' N	109° 27' E	Weigate's Straits, Russia in Europe	70° 50' N	57° 45' E
Varela Isle, Straits of Malacca	3° 47' N	99° 36' E	Weimar, Germany	50° 59' N	11° 21' E
Vavau Isle, Pacific Ocean	18° 34' S	174° 0' W	Wellington Isles, Carolinas	6° 41' N	159° 48' E
Vence, France	43° 43' N	7° 7' E	Werningerode, Germany	51° 51' N	10° 47' E
Vendola Isle, Admiralty Isles	2° 14' S	148° 10' E	Werro Island, Lapland	67° 42' N	11° 25' E
Venice, St. Mark's, Italy	45° 26' N	12° 21' E	Wesel, Germany	51° 39' N	6° 37' E
Venloo, Germany	51° 22' N	6° 11' E	Western Port, Ent., New South Wales	38° 30' S	145° 8' E
Vera-Cruz, Mexico	19° 12' N	96° 9' W	Westerwick, Sweden	57° 45' N	16° 40' E
Verd Cape, West Coast of Africa	14° 44' N	17° 30' W	Westra Island, Noup Head, Orkney I.	59° 19' N	3° 13' W
Verden, Germany	52° 56' N	9° 13' E	Wetter Isle, E. Point, Indian Arch.	7° 46' S	126° 54' E
Verdun, France	49° 10' N	5° 22' E	Wexford Harbour, Ireland	52° 22' N	6° 19' W
Verona Observatory, Italy	45° 26' N	11° 1' E	Weymouth Cape, New Holland	12° 39' S	143° 18' E
Versailles, France	48° 48' N	2° 7' E	Whitby, England	54° 28' N	0° 36' W
Vienna, Portugal	41° 43' N	8° 43' W	Whitehaven Windmill, England	54° 33' N	3° 35' W
Vicenza, Italy	45° 32' N	11° 33' E	Whitsunday Island, Pacific Ocean	19° 26' S	138° 12' W
Victory Isle, Indian Archipelago	1° 34' N	106° 22' E	Whitsuntide Island, New Hebrides	15° 44' S	168° 20' E
Vienna, Germany	48° 13' N	16° 23' E	Whyda, British Factory, W. C. of Afr.	6° 17' N	2° 34' E
Vienne, France	45° 33' N	4° 54' E	Wiborg, Denmark	56° 27' N	9° 26' E
Vigevano, Italy	45° 19' N	8° 52' E	Wiborg, Russia in Europe	60° 43' N	28° 46' E
Vigo, Spain	42° 13' N	8° 33' W	Wicklow High Lighthouse, Ireland	52° 58' N	6° 0' W
Villach, Germany	46° 35' N	13° 52' E	Wildeshausen, Germany	52° 54' N	8° 28' E
Villa de Condé, Portugal	41° 21' N	8° 36' W	William Cape, Celebes	2° 34' S	118° 58' E
Villa del Pao, Terra Firma	8° 38' N	64° 48' W	Williamsburg, United States	37° 16' N	76° 54' W
Villa-Franca, Italy	43° 40' N	7° 19' E	Wilna, Russia in Europe	54° 41' N	25° 18' E
Villalpano, Spain	41° 51' N	5° 24' W	Wilson's Promontory, New Holland	39° 11' S	146° 20' E
Vincent (St.) Cape, Portugal	37° 3' N	9° 0' W	Winchelsea Steeple, England	50° 55' N	0° 43' E
Vincent (St.) Island, Cape Verd Isles	16° 51' N	25° 4' W	Winchester Cathedral, England	51° 4' N	1° 18' W
Vincent (St.) I., Kingston, Carib. I.	13° 11' N	61° 16' W	Windmill Point, United States	37° 36' N	76° 7' W
			Windsor Castle, England	51° 29' N	0° 35' W

The Latitudes and Longitudes of Remarkable Harbours Islands, Shoals, Capes, &c.

Names of Places.	Lat.	Long.	Names of Places.	Lat.	Long.
Winga Beacon, Sweden	57 38N	11 38 E	Yellow River, Entrance, China.....	34 3N	120 0 E
Wisby, Sweden.....	57 39N	18 26 E	Yeu Isle, France.....	46 42N	2 20W
Wittenberg, Germany	51 53N	12 46 E	Ylo, Peru	17 36 S	71 10W
Woahoo Isle, Sandwich Isles	21 40N	158 1W	York (New) Battery, United States ..	40 42N	73 59W
Woerden, Germany	52 5N	4 44 E	York Cape, Greenland	75 56N	66 39W
Wolfenbuttle, Germany.....	52 9N	10 32 E	York Fort, New Wales.....	57 2N	92 35W
Wolf Island, Labrador.....	53 42N	55 36W	York I., Mount Adol., Torres's Straits	10 36 S	142 40 E
Woodham's Isles, Newfoundland ...	49 55N	53 30W	York Minster, England	53 58N	1 5W
Woody Point, W. Coast of America ..	50 0N	127 57W	Ypres, Netherlands	50 51N	2 53 E
Woolverhampton Spire, England.....	52 35N	2 7W	Ysselburg, Germany	51 50N	6 26 E
Workington Chapel, England	54 39N	3 33W	Ystad, Sweden	55 26N	13 48 E
Worms, Germany	40 38N	8 21 E			
Worm's Head, Wales.....	51 34N	4 19W	Zacheo Isle, Porto Rico	18 24N	67 34W
Wreck Reef, Pacific Ocean	22 11S	155 19 E	Zalappa, Mexico.....	19 30N	96 55W
Wrekin Moun'tain, England	52 40N	2 31W	Zante Isle, the Town, Mediterranean..	37 47N	20 55 E
Wurtzburg, Germany.....	49 46N	9 55 E	Zanzibar Road, E. Coast of Africa ...	6 6S	39 33 E
Wurzen, Germany.....	51 22N	12 43 E	Zarizin, Russia in Europe.....	48 42N	44 28 E
Wushnei-Wolotschok, Rus. in Europe	57 35N	34 41 E	Zerbi Isle, the Town, Barbary	33 54N	10 53 E
Wylingoe (Great) Light, Norway ...	59 4N	5 21 E	Ziaret Cape, Syria.	35 37N	35 34 E
			Znaim, Germany	48 51N	16 2 E
Xam-hay, China.....	31 16N	121 32 E	Zumpango, Mexico.....	19 47N	99 4W
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